UNIVERSITY of MARYLAND
BALTIMORE

Administration & Finance

Design and Construction

Architectural and Engineering Design Standards

2024 Edition
Reorganized and Updated December 2024

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Chapter 1: Governance and Policy

Updated November 18, 2024

1.1 Design Standards- General

A. The University of Maryland, Baltimore (UMB)Design Standards apply to the design and construction of University Facilities, for both new building structures and the renovation of existing buildings .
B. Enforcement of the design standards is by the UMB Office of Design and Construction: https://umaryland.gov/designandconstruction
C. These standards apply unless otherwise noted in the project scope or program documents. Where requirements of the standards conflict with other information or requirements of a project and/or site conditions, the UMB Project Manager will be responsible for obtaining resolution and will provide direction to the A/E or builder.

1.2 Supersedure

A. This edition of the Design Standards supersedes all previously issued editions.

1.3 University of Maryland, Baltimore Background

A. Opened in 1807, the University of Maryland, Baltimore (UMB) is Maryland's public health, law, and human services university, dedicated to excellence in education, research, clinical care, and public service.
    1. Mission: To improve the human condition and serve the public good of Maryland and society at-large through education, research, clinical care, and service.
    2. UMB enrolls nearly 6,700 students in six nationally ranked professional schools — dentistry, law, medicine, nursing, pharmacy, and social work — and an interdisciplinary School of Graduate Studies. The University offers 97 doctoral, master's, baccalaureate, and certificate programs and confers most of the professional practice doctoral degrees awarded in Maryland.

1.4 Authority within UMB Campus Boundaries

A. State-Owned Buildings: The State of Maryland owns the physical assets of the University of Maryland, Baltimore (UMB) for the sole use of the University. UMB Facilities and Operations Division is responsible for the design, construction, operations, and maintenance of all components of the built environment on the campus, including buildings, equipment, open space, University-owned streets, and University-owned infrastructure. This responsibility extends to other facilities leased, operated, and/or maintained by the University.
    1. Maryland Codes: https://labor.maryland.gov/labor/build/buildcodes.shtml
B. Public Streets and Utilities: The public streets and sidewalks, and public-service utilities that serve the UMB campus are owned by the City of Baltimore . UMB Facilities and Operations are responsible for coordination of University activities within these rights-of-way.
    1. Baltimore City Codes and Standards: www.baltimorecity.gov

1.5 Institutional Requirements for Design and Construction

A. Institutional Requirements Basis: University buildings, infrastructure, and campus grounds, both new and existing, must meet the functional, aesthetic, environmental, and safety needs of the users, balancing initial cost and life-cycle value.
B. University projects shall use materials and systems that are cost effective and have a long service life. These University Standards are based on systems and materials that have been proven to be durable and maintainable on the UMB campus. Making use of standards for these systems allows us to keep a lower stock of materials and to provide consistent training for staff in use and maintenance.
C. University Teaching and Research Facilities: The elements of building design and construction which comprise proven, low-maintenance and durable materials, flexible and dependable systems, and high-technology systems and equipment result in facilities that provide a suitable environment for forward-focused professional education and advanced research.
D. University Mission: In every aspect of design and construction, the University projects shall support the University's overall mission of improving the human condition and serving the public good.
E. University Standards and Guidelines

    1. These Design Standards incorporate other applicable mandates, policies, and guidelines.

        a. UMB Facilities Master Plan (Master Plan), latest edition
        b. UMB Procedure Manual for Professional Architectural / Engineering Services for UMB Construction and Service Center Projects, latest edition
        c. University General Conditions of the Construction Contract, latest edition at time of contract, unless otherwise specified.

F. UMB Specifications

    1. Consultant teams must use the UMB Specification as their basis for the project design documents and make edits for the project scope and any consultant specific requirements. University standard requirements are incorporated into the UMB Specifications.

        a. If there is a discrepancy between the Standards and Specifications, contact the University Project Manager for a resolution.

    2. Consult the UMB Specifications for specific product selections that are not addressed within the Design Standards document.

1.6 UMB's Sustainability Policy

A. Sustainability Goal: UMB aims to execute the University's mission through the lens of sustainability, and encompasses three central pillars: equity, economy, and environment.

    1. Office of Sustainability https://www.umaryland.edu/sustainability/

B. Sustainability Strategic Plan: The current UMB Sustainability Strategic Plan outlines goals and strategies for University sustainability from 2022 to2026 that support an overarching requirement of carbon neutrality by 2045.

    1. Phases affecting design and construction of projects at UMB fall under the following categories:

a. Utilities and Emissions
b. Campus Planning and Design
c. Waste and Procurement

2. UMB Sustainability Strategic Plan: https://www.umaryland.edu/sustainability/strategic-plan/

C. Legislative Requirements: Projects must comply with various legislative requirements and state-issued standards and specifications for buildings, landscaping, and other aspects of campus development and operations.

1. High Performance Green Building Program
2. Climate Solutions Now Act of 2022
3. Maryland's Building Energy Performance Standards (BEPS)
4. Green Purchasing Specifications from the Department of General Services (DGS)
5. Maryland Sustainable Buildings Act of 2023 (Bird Bill)
6. Department of General Services - State Buildings and Facilities - Energy Conservation and Greenhouse Gas Emissions Reductions

1.7 Implementation of the Design Standards

A. The Design Standards document is intended to define the minimum requirements for the design and construction of new and renovated facilities in accordance with the needs and practices of the University. All project design and construction documents shall be complete, correct, and include appropriate detail to meet the requirements of these standards.
B. A general citation of the Design Standards shall not be sufficient contractual direction or obligation.
C. Deviation from These Design Standards: These Design Standards reflect the functional needs and operational practices which the University has developed through long-term experience in ownership and operation of institutional facilities. However, these requirements are not intended to preclude improvement based on the satisfactory experiences of the A/E and/or builder, or to provide for the needs of a using department.

1. Any proposed deviation from these Design Standards by the A/E shall be submitted as a request using the UMB Standard Request for Deviation Form.
2. Deviations may be proposed to introduce proven alternative practices or to utilize materials, systems and/or procedures which respond to project goals for quality, schedule, and budget.
3. Use of newly developed, untried materials and/or systems is generally discouraged.
4. Proposed deviations or modifications will be considered on an item-by-item basis for each project. Approved modifications for a particular project shall not be construed to be a modification of these Design Standards as a precedent for subsequent projects.

D. Coordination: Coordination of requirements of all divisions is expected of all team members involved in the design and construction of a project. Each design discipline and construction trade is required to seek out all related information throughout the Design Standards that may affect their work. Consultant and Contractor teams are expected to provide Quality control review of the contract documents to ensure that all aspects of the work are included and complete.

1.8 Incorporation of UMB A/E Procedure Manual

A. In addition to the requirements as defined in these Design Standards, the A/E Consultant, and the Construction Manager (Builder) shall comply with the latest edition of the UMB Procedure Manual for Professional Architectural/ Engineering Services for UMB Design and Construction and UMB Service Center projects [A/E Procedure Manual].

1.9 UMB Project Team

A. The UMB Project Manager is the sole responsible point of contact with the University for the project A/E Consultants.
B. Project Team: UMB Project Manager, representatives from the user group, technical review personnel from D&C, Operations and Maintenance, Environmental Health and Safety, Capital Budget Office, Public Safety and the Office of Procurement and Supply (OPS),and others as needed to advise and ensure that the project design meets the requirements and operational needs of the completed facility.
C. Projects funded by the State Capital Improvements Program may be reviewed by a campus-wide Project Overview Committee including the President and Deans and other officials.
D. Contract issues are addressed by the University Department of Procurement.

Chapter 2: University Facilities

Updated and Reorganized December 9, 2024

2.1 University Campus Overview

A. The Campus: The UMB campus consists of 65 acres with 6.3 million gross square feet of space in 57 buildings.

1. UMB Campus Map: https://www.umaryland.edu/maps/

2.2 Streets

A. Most public streets which traverse and service the University campus are owned by the City of Baltimore, though some minor blocks of streets or alley ways are within the property lines of the University Facilities. UMB, in agreement with authorities having jurisdiction, is responsible for coordination of University activities within the Baltimore City rights-of-way.

2.3 Parks and Open Spaces

A. By connecting the campus's open spaces into a network of green areas and parks around the campus, the University is able to create small-scale wildlife refuges for songbirds and beneficial insects on its grounds. In a highly urbanized area, this becomes an important function. The University encourages campus connections to the larger region through support of greenways, fitness walks, bicycling trails, building courtyards, and rooftop gardens.

2.4 Buildings

A. Goal: Provide facilities of the highest possible quality to meet the demands of contemporary learning, research, and work environments. This includes maintaining, adapting, and improving aging facilities
B. Twenty UMB buildings are greater than 50-years old and an additional nine are greater than 25 years old. These include nine facilities life-sciences research labs operate.
C. To ensure long life use of any new building, design of new construction shall incorporate the overall concepts of maintainability, use of long lasting building materials, and quality construction.
D. A list of currently active buildings is available on the Design and Construction website. https://www.umaryland.edu/designandconstruction/building-information/

2.5 University Infrastructure

A. Overview: University Infrastructure includes the supporting utility systems that enable the overall campus and facilities to function. Infrastructure systems must be adequate, reliable, and efficient. Multiple systems comprise the infrastructure systems that serve the campus which include both university and municipal utilities.
B. University Utilities

1. Chilled Water
2. Electrical Distribution
3. Voice and Ductbank – depending on location may be owned by UMB, Baltimore City through lease agreement, or a private telephone utility.

    a. Voice and Data Cabling
    b. Fire Alarm

c. Energy Management
d. Security

4. Pedestrian Lighting

C. Municipal Utilities

1. Primary Electric Power – BG&E
2. Steam piping – Vicinity
3. Natural Gas – BG&E
4. Water distribution, Sanitary and Storm Sewers – Baltimore City Department of Public Works
5. Streets and Street lighting – Baltimore City Department of Transportation

D. Critical Campus Utilities: Critical Systems on campus include electrical distribution, steam distribution, water and sewer connections, and chilled water distribution. Interruptions in any one of these systems can disrupt the function of the campus and buildings, and can cause potential risk to personnel, on-going research, or property.

E. Campus System Descriptions

1. Steam Distribution: Vicinity provides 125 psi district steam directly to most buildings through its proprietary piping system located in street right-of-ways and University property easements. Condensate is used for heat recovery, then cooled and discharged to the storm system. Steam is used to generate heating water and domestic hot water as well as in sterilizers and humidification systems.
2. Chilled Water Distribution: The University owns and maintains three sub grade chilled water distribution loops. These are modified central systems comprised of interconnected chillers in buildings serviced by each loop. The loops are controlled to maximize efficiency through selection of which chillers to operate for various load conditions. Where possible, new projects should connect to existing loops or adjacent building systems.

a. North Loop: Located in the vicinity of Baltimore and Pine Streets,
a) School of Dentistry
b) Pharmacy Hall
c) Medical School Teaching Facility
d) Health Sciences Research Facility (HSRF) 1
e) Health Sciences Research Facility (HSRF) 2
f) Health Sciences Research Facility (HSRF) 3
g) Howard Research Hall
h) Bressler Research Building
i) Institute of Human Virology
j) Allied Health Research Building

b. South Loop: Located in Lemmon Alley between HSHSL and Penn Streets
k) Health Sciences/Human Services Library
l) School of Nursing
m) Campus Center

c. East Loop:
n) School of Social Work
o) Museum of Dentistry
p) Davidge Hall

q) George Gray

3. Electrical Distribution: Primary power at 13.2 kV is purchased from a supplier and distributed to the campus by BGE. The University owns the distribution system from the switching stations to individual buildings.
    a. Four (4) 13.2 kV BGE Feeders serve the Green Street (MSS) substation. These feeders are scheduled for transfer to a new substation on Pratt Street. Four (4) 13.2 kV BGE feeders serve the North Electric Station (NSS) in West Saratoga Street. Each substation is a closed ring bus arrangement.
        i. All secondary feeders are synchronized, the campus uses closed transition switching.
    b. Green Street (MSS) substation has twenty-four (24) circuit breakers. North Electric Station (NSS) has twenty-four (24) circuit breakers, These provide the 13.2 kV distribution network throughout the campus.
    c. Buildings are typically served by two UMB feeders originating from opposite ends of the ring. Smaller facilities may have a secondary (480V or 208V) service from a larger UMB building or directly from BGE.
    d. The campus has backup utility 13.2 kV generation with a capacity of 6 MW at the Peaking Plant on Pine Street and 2 MW at Howard Hall. The system has the capability of paralleling with the utility.
4. Voice Communication: Voice communication is managed by the Center for Information Technology Services (CITS). Telephone service is primarily supported by VoIP. Supplemental lines for elevator, alarm, and emergency phones are served by copper cables owned by either UMB or Verizon.
5. Data Communication: Data Communication is managed by CITS. Data communication uses fiber optic cabling which is extended to all UMB buildings in ductbank. UMB manages fiber distribution throughout the UMB campus, MIEMSS, UMMS and UPI buildings as well as the Veterans Administration Medical Center.
6. Ductbanks: UMB has a proprietary communications ductbank system for fiber and copper cables. UMB leases Baltimore City duct bank, which also is used extensively by BGE. Two citywide ductbank systems are owned by Baltimore City and Verizon. UMB have no rights of access to Verizon duct banks. The majority of UMB power cables and some of the fiber optic and signal (fire alarm, card access, energy management) cables are in this system.
7. Optical Fiber: There are dedicated fiber systems for Campus IT Networks, Fire Alarm, Building Automation, and the Campus Security Camera Network. UMB has a proprietary communications ductbank system.
8. Public Rights-of-Way and Easements: University holds franchise agreements with Baltimore City to install and maintain utility lines in the city-owned rights-of way. Projects interacting within the City Right-of-Way will be reviewed, approved, and inspected by the city. The city and private utility companies hold utility easements in University-owned properties. Work in and around these easements is subject to Baltimore City review and approval.

2.6 Archive Files and Project Documents

A. Documents Furnished: UMB documents are available through the UMB D&C web site and FTP Archives site. Consultants and vendors are expected have access to relevant building codes and regulations.
B. Existing Building Records: The FTP Archives is a digital archive containing record drawings of construction documents (drawings and specifications), existing utility plans, and topographic plats. Some files date to 1929. No assurances are given that such record documents are complete or accurate in the current conditions. It shall be the responsibility of the A/E team to verify existing conditions as necessary for accurate design of construction and/or use of the facility.
C. Campus and Utility Plans: The A/E shall use the campus site and utility plan(s) for general reference to supplement any specific land survey prepared by the A/E for the project base drawing file. At completion of the 100% CD phase, the drawings of the completed site work shall be submitted to University shall be included in the Record Document submission as well.

End of Chapter

Chapter 3: Building Codes And Review Agencies

Updated October 23, 2024

3.1 Scope

A. This section outlines the applicable building codes, standards, and review agencies enforced for the design of new building structures and the renovation of existing buildings. New building structures shall include, but not be limited to, institutional quality buildings for general office, research, instruction clinics, support spaces, and parking garages.
B. Unless otherwise noted, the latest edition of the codes in effect at the time the design contract is awarded will be used throughout the design and construction of that project.

3.2 Jurisdiction

A. The design and construction of University-owned and funded facilities on State property shall comply with the Maryland Building Performance Standards (MBPS) COMAR 09.12.51 and the Model Performance Code (MPC) COMAR 09.12.50. Copies of the most current editions are available at the Department of State Documents website.
B. UMB Office of the Fire Marshal (OFM), acting on behalf of the Maryland Office of the State Fire Marshal, serves as the authority having jurisdiction (AHJ) and building code official for the campus community.
C. UMB Environmental Health and Safety (EHS) Department is the appointed campus Occupational Safety and Health Coordinator
D. Baltimore City Codes are not in force on UMB (State of Maryland) property. Baltimore City does not inspect, or issue occupancy permits for University facilities.
E. When indicated, projects may require additional review and coordination with regulations of emergency response agencies and utility services furnished by others,

    1. The review of design and/or construction by agencies external to University shall be coordinated in consultation with the UMB Project Manager prior to contact of the agency by the A/E or contractor. These agencies include the Architectural Review Board(s), AAALAC, Maryland MDE/DOE, the State Fire Marshal, Baltimore City Department of Public Works/Traffic and Transit, and others as applicable.

3.3 Codes and Standards: Applicable building codes and standards

A. MBPS - The Maryland Building Performance Standards (Maryland applicable building codes and standards) COMAR 09.12.51
B. MPC - The Model Performance Code (Maryland applicable standards for construction of Industrialized/Modular buildings and State Buildings) COMAR 09.12.50
C. Maryland Accessibility Code Guidelines for Buildings and Facilities, COMAR 09.12.53
D. Maryland Fire Prevention Code COMAR 29.06.01
E. The Maryland Department of Labor maintains a code matrix with all current applicable codes: https://labor.maryland.gov/labor/build/buildcodematrix.pdf
F. ASHRAE Standards:

    1. ASHRAE Standard 15, Safety Standard for Refrigeration Systems
    2. ASHRAE Standard 34, Designation and Classification of Refrigerants
    3. ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quantity
    4. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low–Rise Residential Buildings

5. ASHRAE Standard 90.2, Energy Efficient Design of Low–Rise Residential Buildings

G. Electrical Design Standards and Regulations: In addition to those codes referenced above, the basis for electrical design shall also include amendments and revisions of the following standards and regulations:

1. National Electrical Manufacturers Association (NEMA),
2. Institute of Electrical and Electronics Engineers (IEEE),
3. Edison Electric Institute (EEI),
4. Electronic Industries Application (EIA),
5. Insulated Power Cable Engineers Association (IPCEA),
6. Certified Ballast Manufacturers Association (CBM),
7. American National Standards Institute (ANSI),
8. American Society of Mechanical Engineers (ASME),
9. American Concrete Institute (ACI),
10. Underwriters Laboratories, Inc. (UL),
11. Illuminating Engineering Society of North America (IES),
12. Baltimore Gas and Electric Company rules and regulations

3.4 Review Authority

A. MBPS - The Maryland Building Performance Standards and MPC - The Model Performance Code as reviewed by designated university representatives unless otherwise noted here.
B. Maryland State Fire Prevention Code (COMAR 29.06.01) as reviewed by the UMB Office of the Fire Marshal (OFM).
C. Safety Code for Elevators, Dumbwaiters, Escalators, and Moving Walks, known as ANSI A17.1 (COMAR 09.12.81 through 09.12.83) both reviewed in construction by a designee of the Commissioner of Labor and Industry
D. Maryland Department of the Environment Sediment and Stormwater Plan Review Division reviews construction plans on state and federal projects for consistency with Stormwater Management regulations (SWM) and Erosion and Sediment Control (ESC) regulations, then issue approval.

1. Projects disturbing less than 5000 sf are exempted from SWM, and if the disturbance is also below 100 cy, no ESC review or approval is required.
2. Reference: https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Pages/PlanReviewforStateandFederalProjects.aspx

E. Department of General Services, State Board of Architectural Review.

1. Maryland State funded capital construction projects shall submit for review at Schematic Design Phase. Additional submissions if needed as directed by the UMB Project Manager.

F. The Design Advisory Panel (DAP) Department of Planning, Baltimore City

1. Required for new Capital Improvement Projects which improve or face upon a Baltimore City Public right-of-way.

G. Department of Public Works “Book of Standards,” and the Department of Traffic and Utility Engineering

1. Required for projects within the Baltimore City Public right-of-way

H. Maryland State Police Aviation Division

1. Coordination required for projects located within the MIEMSS helicopter approach zone in accordance with FAA designated flight paths

I. Baltimore Gas & Electric (BGE)

1. Projects connecting directly to BGE Power or Natural Gas systems

J. Miss Utility

1. Annotated Code of Maryland Public Utilities Article Title 12 requires a person/company that intends to perform an excavation/ demolition in the State to contact Miss Utility to create a ticket. Person(s)/Companies may only excavate/demolish upon clearance from the Miss Utility Call Center. https://www.missutility.net/maryland/

K. Vicinity Energy

1. Projects using district steam service

L. The Maryland Historical Trust

1. For all projects involving state historical landmarks, or buildings within designated historical districts, considered to be of historical interest as coordinated through the UMB Project Manager

3.5 Research and Animal Facilities

A. Research and Animal Facilities require additional compliance with industry and governmental standards as directed by the UMB Project Manager coordinating with UMB Environmental Health and Safety (EHS) and UMB Department of Veterinary Resources. UMB research is funded in part from National Institute of Health (NIH). University Research Facilities must comply with all applicable Federal statutes, regulations, and policies. This list of Standards is not all-inclusive. Refer to project scope and program for full requirements. Use the most recent version of the standard at the time of design.

B. Research Facilities Standards:

1. Current International Building Code (IBC)
2. *Biosafety in Microbiological and Biomedical Laboratories (BMBL),* Centers for Disease Control and Prevention, National Institutes of Health
3. Occupation Safety and Health Administration(OSHA):
    a. Occupational exposure to hazardous chemicals in laboratories, 29 CFR 1910.1450
    b. Bloodborne pathogens, 29 CFR 1910.1030
    c. Flammable and combustible liquids, 29 CFR 1910.106
4. Centers for Disease Control and Prevention (CDC) and NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL)
5. *National Fire Protection Association (NFPA) 45,* Standard on Fire Protection for Laboratories Using Chemicals
6. American National Standard for Emergency Eyewash and Shower Equipment

   a. ANSI/ISEA Z358.1-2014 (R2020)

7. American National Standard for Laboratory Ventilation,
   a. ANSI/AHIA Z9.5-2003
8. Biosafety Cabinetry: Design, Construction, Performance, and Field Certification
   a. NSF/ANSI 49-2022
9. Methods of Testing Performance of Laboratory Fume Hoods
   a. ANSI/ASHRAE Standard 110-2016
10. Industrial Ventilation: A Manual of Recommended Practice – 31st Edition. The American Conference of Governmental Industrial Hygienists (ACGIH)
11. National Institutes of Health (NIH) Design Requirements Manual (DRM)

C. Laboratory Animal Facilities

1. Animal Welfare Act and Animal Welfare Regulations (USDA)
2. NIH Office of Laboratory Animal Welfare Rules and Regulations.
3. The Public Health Service Policy on Humane Care and Use of Laboratory Animals (PHS Policy) [NIH OLAW]
4. Guide for the Care and Use of Laboratory Animals (NRC 2011) - American Association for the Accreditation of Laboratory Animal Care (ILAR)
5. Guide for the Care and Use of Agricultural Animals in Research and Testing, Current edition,
6. American Veterinary Medical Association Guidelines
7. U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training (NIH)

End Of Chapter

Chapter 4: Research Laboratory Design

Modified November 15, 2024

4.1 Codes And Standards

A. All laboratory designs shall comply with the codes and standards included in Chapter 3: Building Codes and Review Agencies of these Design Standards.

4.2 General Requirements

A. General: The following requirements have been developed from experience in the design, operation, and maintenance of research laboratories on campus. These requirements do not to apply to other spaces described as “laboratory,” such as computer labs or “simulation labs,” etc. These requirements are intended to provide a “check list” of customary needs that are provided according to the practices and means of the University, and are to supplement, or be coordinated with, other specific criteria in these Design Standards. These requirements shall apply to both new and renovated laboratories, as well as accommodate any special needs as directed by the responsible school or institute.

B. Environmental Health and Safety Department (EHS): The University’s EHS Department is responsible for the safety and health design aspects for laboratories and supporting spaces and is the primary contact for laboratory design issues related to safety and health. EHS shall be included in all phases of the laboratory design process as an active member of the design team throughout the design and construction process. This is particularly important in the design of high-level containment facilities such as Biological Safety Level 3 (BSL-3) and Animal Biological Safety Level 3 (ABSL-3) facilities. Contact information for EHS is listed below, but coordination with EHS shall be through UMB.

C. Regulatory Interpretations and Variance Requests: The A/E shall submit requests for regulatory interpretations or variances to UMB, who will forward them to EHS for review. All requests and responses shall be in writing.

D. Animal Facilities: Animal facilities shall be designed in accordance with the requirements of the American Association for the Accreditation of Laboratory Animal Care (AAALAC) and shall be reviewed and coordinated with the University Director of Veterinary Resources as directed by UMB.

4.3 Campus Laboratories

A. Common types of laboratories present on campus have been categorized as:

1. Standard Laboratory
2. Biological Safety Level 2 (BSL-2)
3. Biological Safety Level 3 (BSL-3)
4. Animal Biological Safety Level 3 (ABSL-3)
5. Surgery: Survival
6. Surgery: Non-Survival
7. Animal Holding Rooms
8. Photo Dark Room
9. Laser
10. Electron Microscope
11. Prosthetics (dental)

4.4 General Laboratory Requirements

A. Architectural

1. Division 08 – Openings - Doors: Doors to laboratories shall be thirty-six (36) inch to forty four (44) inch, single leaf type doors. Larger doors or multiple leaf doors shall only be used when necessary to accommodate special equipment and/or furniture. Multiple leaf doors shall be used only when necessary to accommodate special equipment and/or function. Provide a "half door" tempered glass view window (retrofit on renovations) at doors to labs. Hardware shall include removable cylinder, entrance function (lock/unlock jamb selection) lever, heavy-duty stainless hinges, brushed stainless kick plates both sides, and a closer.
2. Division 08 – Openings - Windows (if applicable): Non-operating, sealed. Light control: one (1) inch horizontal blinds. For renovations in existing buildings, the already established window treatment shall be used.
3. 092900 – Gypsum Board - Walls: Five eighth (5/8) inch gypsum board.
4. 123600 Wood Laboratory Furniture: Laboratory furniture must be capable of supporting anticipated loads and uses. Spaces between benches, cabinets, and equipment should be accessible for cleaning.
    a. Bench tops must be impervious to water and resistant to heat, organic solvents, acids, alkalis, and other chemicals.
    b. Chairs used in laboratory work must be covered with a non-porous material that can be easily cleaned and decontaminated with appropriate disinfectant.
5. Casework: See Furnishings
6. Architectural Finishes, Except as Noted in Special Laboratory Use:
    a. 096519 – Resilient Tile Flooring - Floors: Twelve (12) inch x twelve (12) inch commercial grade vinyl composition tile in up to three colors. Leave one carton of each color in laboratory as attic stock. Carpets and rugs in laboratories are not permitted.
    b. Base: Four (4) inch vinyl cove.
    c. 099123 Interior Painting - Walls: Three (3) coat acrylic latex eggshell, semi-gloss, or satin finish paint.
    d. 095123 Acoustical Tile Ceilings - Ceiling: Twenty-four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch, painted suspended grid with lay-in fissured acoustical tile. Provide one carton in laboratory as attic stock.

4.5 Special Laboratory Requirements

A. Minimum Standards: In addition to the general laboratory requirements above, the minimum standards for special laboratories shall be included in the design as follows:

1. Standard Laboratories: Standard laboratories should be designed so that they can be easily cleaned and should include the following:
    a. 096516 Resilient Sheet Flooring - Floor: Welded seam vinyl sheet.
    b. Base: Four (4) inch integral seamless vinyl.
    c. Walls: Extend studs and gypsum board on laboratory side to deck above to seal room.
    d. 115313 – Laboratory Fume Hoods

i. General Purpose Low Flow Fume Hoods: General purpose low flow fume hoods with a lockable ventilated storage cabinet.
ii. Special Purpose Fume Hoods: Special purpose fume hoods are radio isotope and/or perchloric acid hoods with lockable storage cabinets.

2. Biological Safety Level 2 Laboratories (BSL-2): The BSL-2 laboratories should be designed so that it can be easily cleaned and decontaminated.

   a. Floor: Welded seam vinyl sheet.
   b. Base: Four (4) inch integral seamless vinyl.
   c. Walls: Extend studs and gypsum board on laboratory side to deck above to seal room.
   d. Doors: Provide perimeter gasket seal, closer.
   e. Ceiling: Lay-in panels shall be mylar faced, with hold down clips and perimeter sealant.
   f. Incubator with Tanked Gas: Provide space for equipment and secure blocking for tanks as directed. External location of tanks is preferred with sealed supply through wall.
   g. 115353 Biological Safety Cabinets - Biological Safety Cabinets (BSC): Biological safety cabinets must be installed so that fluctuations of the room air supply and exhaust do not interfere with the proper operations of the BSC.
   h. Room Temperature: Constant room temperature may be required. If so, provide wall insulation with a taped vapor barrier, possible batt insulation in ceiling as directed.
   i. Decontamination: A method for decontaminating all laboratory wastes should be available in the facility (e.g., autoclave, chemical disinfection, incineration, or other validated decontamination method).

3. Biological Safety Level 3 Laboratories (BSL-3)

   a. Biological Safety Level 3 (BSL-3) Facilities: EHS maintains a design specification for BSL-3 facilities that is periodically updated. At the inception of a project involving a BSL-3 facility, UMB will contact EHS to obtain the current version of the design specification and forward it to the consultant.
   b. A/E design team must coordinate the designs for biological safety level areas with UMB.

4. Animal Biological Safety Level 3 Laboratories (ABSL-3):

   a. Animal Biological Safety Level 3 (ABSL-3) Facilities: EHS maintains a design specification for ABSL-3 facilities that is periodically updated. At the inception of a project involving an ABSL-3 facility, UMB will contact EHS to obtain the current version of the design specification and forward it to the consultant.
   b. A/E design team must coordinate the designs for biological safety level areas with UMB.

5. Surgery Laboratories, Survival: Laboratories designed as survival operating room suite also shall include:

   a. Prep Areas: Prep room, recovery room, gown room, ante room and area for monitoring equipment as directed by UMB.
   b. Floor: Epoxy membrane or seamless vinyl equal to “Armstrong Medintech”

c. Base: Integral coved six (6) inch high epoxy membrane with stainless steel termination molding and sealant
d. Walls: 5/8 inch “Dens-shield” or equal. Fiberglass tape seal; over (tapered) joints. Skim coat with “Sto Industries Flexyl” or equal polymer-based Portland cement coating system and a water reducible epoxy coating system for wet areas.
e. Ceiling: Five eighth (5/8) inch M.R.Gypsum board with epoxy paint same finish as walls. All penetrations must be sealed.
f. Doors and Frames: Epoxy paint finished galvanized steel with “hospital” sanitary stops. Provide vision panels. Stainless steel armor plates on both sides. Side of door in direction of travel shall have flush hardware. Perimeter seals.
g. Protection: Same as animal holding rooms.

6. Surgery Laboratory, Non-Survival: Non-survival operating room may be within the laboratory, but may require a prep room/area, scrub room, and gown room as directed.

   a. Ceiling: Twenty-four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch baked-on enamel aluminum grid with mylar or vinyl faced lay in panels with hold-down clips and perimeter sealant.
   b. Doors and Frames: Standard doors with vision panels, stainless steel armor plates on both sides and flush hardware.
   c. Protection: Same as animal holding rooms.

7. Animal Holding Rooms:

   a. Floor: Slope to floor drains. Epoxy membrane waterproofing with non-slip surface, impact, and dynamic loading resistant
   b. Base: Eight (8) inch high integral coved epoxy membrane with sealed metal termination strip.
   c. Walls: inch “Dens-shield” or equal over metal studs with fiberglass tape five eighth (5/8) seal over tapered joints. Skim coat with “Sto Industries Flexyl” or equal polymer-based Portland cement coating system and water reducible epoxy coating system specified for wet areas.
   d. Ceiling: Twenty-four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch wide baked-on enamel finished aluminum grid for damp area. Mylar-faced cleanable tiles with hold down clips
   e. Doors and Frames: Sealed, epoxy painted galvanized steel with “hospital” sanitary stops and stainless steel armor plates on both sides. Rooms shall have doors with floor sweeps, vision panels with light sealed doors, full open or swing away hinges and flush hardware on side in the direction of travel.
   f. Protection: Vinyl, aluminum or stainless steel guard rails and brackets at thirty six (36) inch rail height within cage areas. At stud line provide either 16 gauge x twelve (12) inch galvanized steel backer plate with stud stiffeners, or six (6) inch x 16 gauge continuous track stud.

8. Photo Dark Rooms:

   a. Commonly, traditional wet photo dark rooms are used; however, prefabricated modular units may be used as approved by the responsible school.

b. General laboratory standards shall be modified as follows:

i. Light Lock: Provide a light-lock vestibule or circular light-lock dark room door with appropriate light seals.
ii. Ceiling: Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch grid, Mylar or washable vinyl faced lay-in panels with hold down clips and perimeter sealant.
iii. Bench Tops: Traditional black acid-resistant laboratory grade HPDL with drip edge, back and side splashes, and shelving.

9. Laser Laboratories:

a. Location: Space may be located in the center of the building and should be free of vibration transmitted from generator rooms, mechanical equipment, etc. Room may require raised vibration isolated floor system.
b. Floors: Anti-static, VCT.
c. Ceiling: Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch suspension system with mylar or vinyl faced acoustical tile, hold down clips with sealant. Some labs may require acoustical batt insulation above ceiling.
d. Other Considerations: Some labs may require provisions for connection to the building process cooling water system water. See Chapter 19: Mechanical Design General Requirements of these Design Standards for additional requirements.

10. Electron Microscope Laboratories:

a. Location: Space should be free of vibration transmitted from elevators, generator rooms, mechanical equipment, etc.
b. Floors: Anti-static VCT.
c. Ceiling: Twenty four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch suspension system with mylar or vinyl faced acoustical tile, hold down clips with sealant. Some labs may require acoustical batt insulation above.
d. Lighting: Parabolic light supplement with recessed pinhole or track-mounted incandescent lighting with dimming.
e. Other Considerations: Some labs may require provisions for connection to the building process cooling water system water. See Chapter 19: Mechanical Design General Requirements of these Design Standards for additional requirements.

11. Prosthetic Dental Laboratories:

a. Floors: Welded seam sheet vinyl in wet areas, VCT acceptable in dry areas. Light color without pattern.
b. Ceiling: Twenty-four (24) inch x forty eight (48) inch x fifteen sixteenths (15/16) inch suspension system with mylar or vinyl faced acoustical tile, hold down clips with sealant. Some labs may require acoustical batt insulation above.

4.6 115313 Laboratory Fume Hoods

A. General Design Requirements: The A/E design team must coordinate the designs for low flow chemical fume hoods and biological safety cabinets with UMB. All laboratory renovation and new construction must be in accordance with the most current version of National Fire Protection Standard (NFPA) 45 “Fire Protection for Laboratories Using Chemicals”.
B. Prioritize Variable Air Volume (VAV) over Constant Air Volume (CAV) fume hood installation to reduce energy use and operating costs.
C. Audio and Visual Alarms: All general purpose low flow fume hoods, special purpose fume hoods and biological safety cabinets shall be specified to have local audio and visual air flow alarms, as required by UMB and EHS. In addition, specify that each alarm shall be tied into the campus energy management and control system for remote monitoring.
D. General Purpose Low Flow Fume Hoods: The A/E shall specify that all general purpose fume hoods must be low flow hoods and must be installed in accordance with ANSI/AIHA Standard Z9.5-2003 “American National Standard for Laboratory Ventilation”. Specify that a wire mesh screen with openings no less than one quarter (1/4) inch x one quarter (1/4) inch be provided with all fume hoods. This screen shall be installed at the base of the baffle at the back wall of the fume hood.
E. Special Purpose Fume Hoods: The A/E shall specify that all special purpose fume hoods must be installed in accordance with ANSI/AIHA Standard Z9.5-2003 “American National Standard for Laboratory Ventilation”. Specify that a wire mesh screen with openings no less than one quarter (1/4) inch x one quarter (1/4) inch be provided with all fume hoods. This screen shall be installed at the base of the baffle at the back wall of the fume hood.
F. 115353 Biological Safety Cabinets: Biological safety cabinets must be selected and installed in accordance with CDC/NIH’s publication entitled “Primary Containment for Biohazards: Selection, Installation and Use of Biological Safety Cabinets”. In addition, all biological safety cabinets must be constructed and certified prior to use in accordance with National Sanitation Foundation Standard No. 49 (NSF, 2007) “Class II (Laminar Flow) Biohazard Cabinetry”.

    1. Biological safety cabinets must be installed so that fluctuations of the room air supply and exhaust do not interfere with the proper operations of the cabinet. BSCs should be located away from doors, windows that can be opened, heavily traveled laboratory areas, and other possible airflow disruptions. Biological safety cabinets exhaust to general laboratory exhaust, either indirect thimble or near the general room exhaust as directed. HEPA filtered exhaust air from a Class II BSC can be safely re-circulated back into the laboratory environment if the cabinet is tested and certified at least annually and operated according to manufacturer’s recommendations.

4.7 130300 Controlled Environmental Rooms

A. General: Specify a complete prefabricated environmental room with all metal clad construction, furnished and installed as a complete self-contained unit with all essential, plenums, controls, balanced air circulation, to maintain the specified environmental conditions as identified in the project program and/or as directed by UMB.

B. Refrigeration System: Include in the specifications the requirements for the refrigerant system to come with water cooled compressors and air cooled backup systems. See UMB Master Specifications.
C. System Controls: Include in the specifications the requirement for the system controls to include auxiliary contacts to send an alarm signal the BAS and connect the room to the building emergency power system.

End of Chapter

Chapter 5: Space Use and Planning

Updated September 12, 2024

5.1 Space Planning

A. Centralized Spaces: The A/E team shall investigate the consolidation of programmatic requirements by providing centralized spaces for server rooms, sterilizer equipment, glass and cage washers, chemical storage, and other services to minimize the requirements for special mechanical and electrical systems. The investigation should include an analysis of the potential impact of these centralized spaces on the program requirements.

B. Loading Dock: The A/E team shall include in the design a loading dock, including an elevated platform, for the management of pickup and delivery of materials.

C. Area of Refuge: The A/E team shall include in the design a designated area of refuge on each floor above the building exit level. The area of refuge shall include provisions for a campus phone, two automatic defibrillators, and appropriate signage.

D. Access To Elevator Machine Rooms And Roof Areas

1. Access to elevator machine rooms and primary roof areas shall be provided by means of a stairway with a landing at the top. Vertical ladders and alternating tread stairways shall not be used unless approved by UMB.
2. To access different secondary roof levels with no equipment installed on them, provide exterior roof access ladders with safety treads and a full height safety cage assembly.
3. Consideration should be given to including in the design a service elevator stop at the roof level for large equipment removal from the roof area.

5.2 Program Space Use And Building Service Spaces

A. Program Space Use: Space assigned to program use is governed by the space-use guidelines published in the Facility Program Manual, Maryland Department of Budget and Management (DBM), as current at the time of approval of each project program or as directed by the UMB Project Manager. Program space shall be calculated and categorized according to the Higher Education Facilities Inventory Survey and Classification Manual (HEGIS) or as directed by the UMB Project Manager. Program space shall be described as “Net Assignable Square Footage” (NASF). The A/E shall tabulate NASF by HEGIS category for review by the University prior to submittal to the Department of Budget and Management (DBM) at the conclusion of the Schematic, Design Development and Construction Documents Phases of design. Building total “Gross Square Footage” (GSF) also is reported to the DBM for review.

B. Building Service Space: In addition to the program space required by the project program, the design of each project shall include necessary general use and service spaces. Quantification of general use space shall be determined by building code requirements, such as toilet rooms, emergency egress stairs, elevators, etc., and/or by functional necessity, such as equipment rooms, loading areas, etc. General use space (sometimes categorized as “non-assignable area”) is included in the total GSF. The following functions shall be accommodated:

1. General Use Space: The design shall include general use spaces such as common circulation corridors, including the building entrance and service lobbies, floor elevator lobbies, egress routes and stairs, but not space required to access

cubicles or otherwise subdivided rooms. “Ghost corridors” in suites, communicating stairs within departments, etc. are included in NASF.

2. Toilet Rooms: The design shall include toilet rooms for general use in accordance with applicable building codes that specify fixture counts based on occupancy, or as otherwise required by function or by direction from D&C. Other toilet rooms assigned to a specific departmental use, such as athletic center showers, clinical diagnostic suites, and leased operations, shall be included in the calculation of the NASF.
3. Storage and Shipping Rooms: The design shall include rooms to accommodate trash collection or delivery of goods (but not uses specific to departmental use such as solvent or radiological waste, gas cylinder storage, etc.) such rooms shall be provided on grade-level floors. In addition, the design shall include a room for storage of attic stock and excess equipment and materials generated from constructing and furnishing the building. The size and location of this room shall be determined through coordination with the UMB Project Manager.
4. Maintenance and Custodial Rooms: The design shall include a janitors’ closet on each floor for each twenty thousand (20,000) NASF, and a central cleaning equipment and supply storage room. Service rooms shall not be used for other purposes, such as emergency egress or for roof hatches. Provide space for two locker rooms, one (1) male and one (1) female, for the custodial staff. Coordinate the room size and number of lockers with UMB Project Manager.
5. Mechanical Equipment Rooms: The design shall include mechanical equipment rooms of adequate size for the installation and maintenance of all specified equipment and located to minimize the transmission of noise and vibration to the surrounding occupied spaces. The mechanical rooms shall be located to provide direct accessibility from the building service entrance or loading dock to minimize travel through occupied spaces.
6. Electrical Equipment Rooms: The design shall include electrical equipment rooms of adequate size for the installation and maintenance of all specified equipment and located to minimize the transmission of noise and vibration to the surrounding occupied spaces. The electrical rooms shall be located to provide direct accessibility from the building service entrance or loading dock to minimize travel through occupied spaces. Provide electrical distribution closets on every floor as necessary.
7. Voice, Computer, Data, and IT Rooms: As indicated in the project program or as directed by UMB the design shall include voice, computer, data, and IT rooms of adequate size for the installation and maintenance of all specified and/or owner furnished equipment. Consideration shall be given to locating these spaces on each floor adjacent to each other to minimize the number of supplemental HVAC systems serving these spaces. Where IT closets are required on multiple floors these closets shall be stacked vertically to consolidate interconnections between floors. All room locations shall be located to prevent compromising the program space requirements.
8. Water Service Entry Room: For fire service and domestic water service, provide a water service entry room.
9. Fire Command Center: The design shall include a fire command center located adjacent to the primary building entrance.

C. Grossing Factor and Building Efficiency Ratio: DBM establishes guidelines for efficient building design of facilities built with public funds. The ratios are expressed as a “grossing factor” (GSF/NASF), and/or as a “building efficiency ratio” (NASF/GSF).The project program and/or D&C shall establish an acceptable goal for each project based upon its recent experience or that of its peer institutions.

   1. Building designs that exceed the GSF indicated in the project program by 5% must be approved by DBM, and at the discretion of DBM may be reviewed by the appropriate Legislative subcommittee.

End of Chapter

Chapter 6: Additional Project Requirements

Updated December 6, 2024

6.1 Coordination of Drawing Information

A. The prime consultant shall be responsible for the coordination of all drawing information between all disciplines as part of each design phase.
B. For work indicated below grade the coordination effort shall ensure that there are no conflicts between underground utilities for the various services to the building, with each other, with the connections to the city, state, or county infrastructure and/or the locations of the building's structural footings.
C. For work indicated above grade the coordination effort shall ensure that there are no conflicts between the building structural components, ductwork, equipment, terminal units, service space requirements, piping systems, light fixtures, finished ceilings, and equipment shafts adjacent to finished areas. The coordination efforts shall confirm that there is sufficient space above the ceilings in all locations to permit proper installation of all equipment, utilities, gravity drainage piping, services, and systems, considering the locations and depths of structural elements and slabs, and providing the proper space for access and service of all equipment, and for the easy removal of accessible ceiling panels. The coordination efforts shall include the specification and location of all needed ceiling, wall, and floor access panels, shown in the required locations to provide complete and unobstructed access to all valves, balancing dampers, fire dampers, smoke dampers, clean outs, ATC devices, safety switches, duct smoke detectors, equipment, terminal devices, and all other devices requiring periodic access for maintenance and service.
D. The coordination of drawing information shall also ensure that the designed finished elevations of ceilings and accent features in finished areas such as occupied and public spaces are maintained at the construction site.
E. Architectural Design: The architectural design shall be coordinated with the civil, structural, mechanical, fire protection, electrical, and specialty designs.
F. Site Visits: The architect shall make necessary visits to the site to ensure coordination with existing conditions and to make certain that there is adequate space and service clearance for the proposed layout and equipment. The architect shall not rely solely on original construction documents or earlier renovation drawings, as they may not represent the actual existing conditions. The A/E team shall check building dimensions to confirm the accuracy of archived record drawings.
G. A Comprehensive Code Analysis, including any authorized variances and protected emergency evacuation routes, shall be documented in the drawings at the Schematic, Design Development, and all Construction Document Phases of design. "Record Documents" shall update any changes made during construction.
H. Field Engineering: Specify the contractor's responsibilities for field engineering and survey work, including erosion control, traffic management plans, structural lay out, profile staking, etc.

6.2 Economical Design

A. Material Selection: Architectural materials shall be selected and designed to permit acceptable competitive bids. Materials and components shall be efficient and economical for construction and maintenance. Materials selected shall be suitable for the application and shall be coordinated with other aspects of the project.

B. Equipment Selection: Equipment specified should be nonproprietary, except where no other source is available to meet performance requirements. Where a proprietary selection is deemed necessary, a request shall be submitted in writing early in the design stage.

6.3 Building Operation

A. Except for selected shutdown holidays, UMB campus buildings are open to the public for business from 8:00 am to 5:00 pm, Monday through Friday and 8:00 am to 8:00 pm (weekends), but many of the buildings on campus are occupied to a lesser extent at all hours of the day and night, seven (7) days per week. In buildings where public spaces and/or research spaces adjacent to the project area require other hours of operation, the design shall identify construction phasing that has the least impact on the adjacent occupied areas. The design shall include requirements for off-hour work as required for work involving the shutdown of systems or equipment serving the occupied areas.
B. UMB reserves the right to require a total or partial redesign of equipment layouts, at no additional cost or time delay, where the submitted design is, in the opinion of UMB, not in the best interest of UMB.

6.4 Construction Project Sign

A. For new construction projects on the UMB Campus the architect shall include in the construction documents a detail for a non-illuminated free-standing construction project sign. The sign shall include the name of the University, University Logo, Project Title, Project Administration, Architect/Consultants, Construction Manager, Board of Public Works, and Maryland General Assembly Titles with appropriate names below each title and a color illustration of the building.

6.5 University Campus Display Model

A. The University has a scaled display model of the campus including all campus buildings, and public streets passing through the campus. Campus buildings over twenty ((20) years old are represented by white blocks which indicate the general outline and height of the structure. Campus buildings less than twenty (20) years old are represented by detailed color models which include brick, stone and glazing on the exterior and landscaping along the street.
B. For new construction and/or major building additions on the UMB Campus the architect's scope shall include updating the campus model with a model of the new construction. The new construction model shall indicate the building footprint and exterior facades, including brick, stone, and glazing, with color finishes representing the finishes used. The model scale shall match the scale of the existing models. If street scaping is part of the project, include lights, trees, and paving around the new building. The existing University Campus display model is located in the Saratoga Building on the 14th floor.

End of Chapter

Chapter 7: Division 1 Specifications

Updated November 20, 2024

7.1 Format:

A. Provide Division 01 specifications based on UMB Specifications, preferably in individual sections for projects valued over $1 million, or in a combined or short language form for smaller projects, covering at minimum the Supplemental Conditions as applicable to each project:

7.2 010100 Summary of Work

A. Describe the scope of the work covered by the construction documents in sufficient detail to provide a thorough and complete narrative of all relevant and significant aspects of the work covered in the construction documents. At a minimum, the description shall address the scope of work for every discipline, including civil, architectural, structural, mechanical, electrical, and specialty work. Related work under other contracts, owner-furnished equipment and products listed, the contractor's use of premises, occupancy requirements, and the necessary construction phasing requirements shall be included.

7.3 010200 Allowances

A. Identify and schedule cash and quantity allowance provisions; define contractor's costs included and administrative procedures involved. D&C recommends limited use of cash allowances or quantity allowances, and these shall be reviewed with the UMB Project Manager prior to incorporation into the project scope of work.

7.4 010260 Unit Prices

A. Unit prices may be utilized for portions of contracts where the nature of the work is defined but the extent of the work is not known or is likely to change (e.g., excavation and rock removal, temporary cold weather provisions for masonry or concrete installation, etc.).The University will establish a contingency fund to pay for the estimated value established. The A/E shall identify, schedule and coordinate unit prices, units of measurement, estimated quantities, and administrative procedures involved, and shall provide the UMB Project Manager with a description of all unit prices in sufficient time to be included on the Bid Price Form which is to be contained in the Office of Strategic Sourcing and Acquisition Services documents. All unit prices shall be subject to review and approval by D&C.

7.5 020270 Applications For Payment
7.6 010300 Alternate

A. Alternates may be employed to provide electives in the project scope to facilitate matching the construction cost to the available funds. The University recommends limited use of alternates and requires that they be arranged in the priority of acceptance, as directed by D&C. The A/E shall identify and coordinate provisions for alternates to the contract and shall provide the UMB Project Manager with a description of all alternates in sufficient time for inclusion on the Bid Price Form which is to be contained in the Office of Strategic Sourcing and Acquisition Services documents. The construction documents shall reflect the full implications of selection of any or all alternates, either those which may add to or deduct from the scope of work. All alternates shall be subject to the review and approval of D&C.

7.7 010350 Modification Procedures

7.8 010500 Coordination

A. Specify administrative requirements for coordination of various parts of the project, including civil, architectural, structural, mechanical, electrical, and specialty disciplines. Examples include, but are not limited to:

1. Coordination of door hardware with UMB security systems, the UMB lock shop, etc.
2. Assignment of ductbank space by UMB.
3. Assignment of room numbers consistent with the UMB Space Inventory System.

7.9 010450 Cutting and Patching

A. Describe special procedures for cutting and patching one portion of work to accommodate another, as the project scope of work necessitates. Each description shall require that patching and/or replacement work be done by the first installer where possible, or by workmen skilled in the trade(s) involved.

7.10 010950 Reference Standards and Definitions

A. Provide definitions, terminology, and names, addresses, acronyms of trade/code organizations, and a list of reference standards used.

7.11 012000 Project Meetings

A. Documents shall identify requirements and responsibilities for the administration of preconstruction conference(s), regularly scheduled progress meetings, recording and distribution of minutes, and other related administrative procedures involved. Require that minutes be distributed within three (3) working days of every Progress Meeting.

7.12 013000 Submittals Procedures

A. Provide and include in the specifications a complete submittal list for use by the CM or contractor. The submittal list shall include all submittals, samples, and shop drawings required for the project and shall be organized to combine submittals where appropriate.

B. Concrete Environmental Product Declarations – required for High Performance Green Building Projects to comply with the Buy Clean Maryland Act

7.13 013110 Schedules & Reports

7.14 013800 Construction Photographs

7.15 0140000 Quality Control

A. Identify requirements for Contractor's quality control of products and workmanship, inspection and testing laboratories, mock-ups, and field samples at site for review for compliance with applicable quality standards. Specific warranty requirements shall be indicated in relevant sections of the specifications.
B. Electrical Inspections

1. For projects that require electrical inspections, all coordination and fees are the responsibility of the contractor and one of the following shall apply:
2. For projects on the UMB campus, specify that UMB will utilize its internal inspection team for all inspection services. In addition, capital projects may use an independent testing agency, as determined by the UMB Project Manager. Independent electrical testing agency shall be approved by the Maryland State Fire Marshal.
3. For projects on other University campuses, i.e., state owned facilities, all inspections shall be performed by University and/or an independent testing agency as determined by the UMB Project Manager.
4. For projects on other than state owned property, specify that electrical contractor shall obtain and pay for all permits required for all electrical work and associated inspections. An inspection by an independent electrical inspection agency, approved by the Maryland State Fire Marshal, may or may not be requested as determined by the UMB Project Manager.

7.16 015000 Construction and Temporary Facilities

A. Establish parameters for field offices, staging areas, toilet facilities, meeting places, temporary utilities, controls, security, facilities, construction aids, job mobilization, and requirements for installation, maintenance, and removal of same.

1. Construction Project Sign: For new construction projects on the UMB Campus the architect shall include in the construction documents a detail for a non-illuminated free-standing construction project sign.

a. The sign shall include

i. the name of the University,
ii. University Logo,
iii. Project Title,
iv. Project Administration,
v. Architect/Consultants,
vi. Construction Manager,
vii. Board of Public Works, and
viii. Maryland General Assembly Titles
1. with appropriate names below each title and
ix. a color illustration of the building.

b. Provide separate specification for Project Sign under Division 10.

2. Include requirement for traffic management plan submittals if needed.

7.17 016000 Materials & Equipment Delivery, Storage & Handling
7.18 016310 Substitutions
7.19 017000 Contract Closeout

A. List specific administrative end-of-project procedures, closeout submittals, and forms for substantial completion and final completion. Address the punch list procedures, including early acceptance and/or occupancy of parts of the building. Identify all requirements for training of UMB O&M personnel for specific equipment and systems installed.

    1. List specific or unusual requirements for contract closeout stated elsewhere in the specifications.

7.20 019113 General Commissioning Requirements

A. BECx Commissioning: The A/E team shall include the requirement for commissioning of building enclosure systems by an independent commissioning agent to be hired by UMB or the CM, as directed by UMB. The specifications shall include the required procedures of the building envelope commissioning process to properly verify the enclosure systems of the project are installed and performing per the design intent and UMB standards. Specific performance testing requirements for the building enclosure systems shall be provided as part of the project and verified by the independent building enclosure commissioning agent.
B. MEP Commissioning: The A/E team shall include the requirement for commissioning of all mechanical, electrical, and plumbing systems by an independent commissioning agent to be hired by UMB or the CM, as directed by UMB. The design specifications shall include all descriptions and procedures required to completely test the operation of MEP systems provided by the project. The testing of each system shall include, at a minimum, normal operation, failure modes, life safety operations, security operations, and all remote monitoring and notification.

End of Chapter

Chapter 8: Operations and Maintenance Project Manual Requirements

Updated November 19, 2024

8.1 Operation And Maintenance Project Manual Requirements:

A. General: Contractors are required to submit an Operation and Maintenance Manual for every UMB project that includes submittals or shop drawings

8.2 Contents:

A. Manufacturers and Suppliers Director
B. Warranties
    1. Provide copies of product and workmanship warranties associated with products and assemblies.
    2. The University General Conditions require that the entire project, materials, and workmanship be guaranteed for a minimum of two (2) years, beginning with the date of substantial completion. Extensions of the overall two-year period, such as those required by partial occupancy, turn-over or early acceptance of specific operating systems, and longer required warrantee periods for specific material or equipment shall be noted in the applicable section of the technical specifications or incorporated during construction using change orders.
C. Submittals and Operations & Maintenance Manuals
    1. Provide copies of the final approved submittals and associated manufacturer operations and maintenance manuals.
    2. Architectural Submittals: Architectural submittals may include exterior windows and doors, interior doors, door hardware, carpet, ceiling tile, floor tile, environmental control rooms, fume hoods and conveying systems.
        a. Final material selection including patterns and colors shall be noted in each submittal
    3. Mechanical Submittals: Mechanical submittals may include plumbing fixtures, floor and roof drains, plumbing equipment, HVAC equipment, pumps, valves, fire protection, automatic temperature controls, and testing and balancing (TAB) report.
    4. Electrical Submittals: Electrical submittals may include main building switch gear, distribution panels, motor control centers, lighting fixtures, wiring devices, emergency generator, fire alarm systems, security systems, and A/V systems.
    5. Submittals shall be organized by discipline, by specification section within each discipline, and in order under each specification section if more than one submittal or shop drawing is included under that section.

8.3 Table of Contents List

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C. Manufacturers and Suppliers Directory
D. Warranties
E. Submittals and Operations & Maintenance Manuals
    1. Civil/Site Work
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    b. Division 03 - Concrete
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6. Site Work
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F. Contractors Closeout Documents
    1. Include CAD Files and PDF Files
    2. Fire Protection Drawing Files
    3. Fire Alarm Drawing Files
    4. Communication Drawing Files
    5. Security System Drawing Files

End of Chapter

Chapter 9: Existing Conditions

9.1 Hazardous Materials:

A. Renovations and/or demolition to receive new construction may encounter quantities of exposed, encapsulated, or otherwise concealed hazardous materials such as asbestos, polychlorinated biphenyls (PCB) lighting ballasts and lead paint. Usually, the cost of abatement will be funded from the project construction budget. Due to consultant liability issues, abatement design will not be included in the scope of design work. The University will contract separately for removal and disposal.

End of Chapter

Chapter 10: Structural Design

Updated December 6, 2024

This Chapter Covers the following Divisions:

Division 3 – Concrete
Division 4 – Masonry
Division 5 – Metals

10.1 Scope:

A. This part outlines the minimum requirements for the design procedures for structural systems, for new buildings, and repair and alteration projects for existing buildings on the UMB campus.

10.2 American Steel:

A. Only structural steel products manufactured in the United States shall be used or supplied for construction of University buildings. Steel products include all products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or otherwise similarly processed from steel made in the United States. Request for deviation from the requirement to use only American steel must be submitted in writing to the UMB Design and Construction Department. Provide a market analysis that demonstrates that the cost of such steel products is unreasonable or inconsistent with the public interest and that the substitution is not in conflict with Federal Grant Regulations affecting the project.

10.3 Codes And Standards:

A. Steel Structures: The A/E shall employ either of the design codes listed below. The code used must be indicated on the construction drawings and listed in the specifications, and shall require a certification that the particular code has been used consistently for all structural steel design and construction.

1. Manual of Steel Construction, Load & Resistance Factor Design, Third Edition, 2001, American Institute of Steel Construction, Inc., herein referred to as "LRFD".
2. Manual of Steel Construction, Allowable Stress Design, Ninth Edition, 1989, American Institute of Steel Construction, Inc., herein referred to as "ASD".

B. Concrete Structures: The design of concrete structures shall comply with the codes listed in Chapter 3: Building Codes and Review Agencies and the following codes:

1. Building code requirements for reinforced concrete, ACI 318-02, American Concrete Institute, or current edition at the date for approval of the Design Development phase.
2. Commentary on building code requirements for reinforced concrete, ACI 318-02, American Concrete Institute, or current edition at the date for approval of the design development phase.

C. Concrete EPD – Environmental Product Declarations

1. For High Performance Building Projects, the contractor must provide the following submittals. Add these requirements to the specifications:

a. Product Data: For each type of product.
b. Sustainable Design Submittals:

i. Environmental Product Declaration: For each product.
ii. Product Data: For coatings, indicating VOC content.
iii. Laboratory Test Reports: For coatings, indicating compliance with requirements for low- emitting materials.
iv. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
    1. Inventory or HPD to at least 0.01 percent by weight with no GreenScreen LT-1 or GHS Category 1 hazards.
    2. Inventory or HPD to at least 0.01 percent by weight, with at least 75 percent assessed using GreenScreen Benchmark assessment.
    3. Third-party-verified Declare product label, designated "Red List Free."
    4. Material Health Certificate or Cradle to Cradle certification with minimum Bronze level of Material Health.

10.4 Structural Design:

A. At commencement of design, the A/E team and UMB shall review the requirements of the program, foundation and site conditions, budget, materials, market, and schedule constraints, and develop recommendation(s) for the proposed structural system.
B. When multiple structural systems, can be designed for a project, the A/E shall submit documentation to UMB detailing the desirable and undesirable aspects of each proposed system, including estimated costs and schedule impact of each system, as part of the Schematic Design Phase.
C. All structural design shall be in accordance with the structural capacity requirements indicated herein as well as with any specific requirement of the project program. All structural loads used for design shall be shown in the construction documents, both on drawings and in the specifications. A graphic column schedule indicating the design loading for all columns shall be included in the structural drawings.
D. The A/E shall be responsible for the design of all connections, and shall review for approval the design and detailing of all connections submitted by each fabricator for compliance with the design. All connection design and details, and shop drawing submittals shall bear the hand-signed seal of the responsible registered professional structural engineer licensed in the State of Maryland.
E. Except with extraordinary justification, as approved by UMB, pre-stressed and post-tensioned concrete shall not be used in academic buildings. An exception which has precedent in campus building is the use of precast pre-stressed double-T structural members in long-span garages.
F. Construction documents shall clearly indicate all requirements for mixing, transport, placement, finishing, curing, and testing of structural concrete. Requirements for cutting and patching of structural work during construction shall be defined, including unit costs as applicable. Non-structural fill concrete shall be addressed.
G. The material characteristics of concrete require an exceptional effort in coordination of all trades for placement of inserts, penetrations, clearances, etc. All details shall be titled to indicate both the subject of the drawing and its location(s) within the structure. Uncoordinated standard structural details without direct application to specific conditions in the project will not be permitted.
H. All structural construction documents, including shop drawings for connections and details, shall bear the hand-signed seal of the responsible structural engineer registered in the State of Maryland.

10.5 Structural Capacity And Notation:

A. Building Code Requirements: Building code requirements for floor and roof structural live loading shall be the minimum criteria for all building design. The minimum design loading shall be increased for institutional use as required herein or in the project program, or upon direction of the UMB. Specific consideration shall address the weight of special equipment and/or operations, as well as the control of vibration and/or deflection to meet operational requirements.

B. University Specific Live Load Requirements: Desired flexibility for re-use and consideration of long-term durability requires the following design and construction structural capacity for specific building functional types:

1. Live Loads: Generally, minimum floor live loads for all occupancies including administration, except parking and residential projects built by others, shall be 80 psf (pounds/square foot) with maximum deflection of L/360. In this, particular attention shall be given special equipment needs and Code requirements for corridors, stairs and assembly rooms which may require 100 psf. Live loading for wet laboratory floor plates shall be a uniform minimum 100 psf, with maximum deflection of L/750, including corridors, toilet rooms, building support, and office/ conference/teaching areas, in order to provide flexibility across the entire floor plate for future renovations and/or changes in equipment. Concentrated laboratory support and equipment areas shall be designed as specifically required for initial occupancy with 100 psf as the minimum capacity.
2. Building Systems Rooms: Include equipment penthouses, mechanical equipment and switchgear rooms, elevator machine rooms, emergency power equipment, and similar facilities, shall have a minimum live load capacity of 150 psf with maximum allowable deflection of L/750.
3. Pads: Housekeeping pads, nominally four (4) inches high, shall be separated from the structural system and not contribute to the design capacity of the floor.
4. Roof Areas: Roof areas designated for equipment shall have a minimum live load of 150 psf, plus 30 psi snow load, or as required by Code.
5. Parking Decks: Parking Decks shall have a minimum live load of 50 psi with maximum deflection of L/360. Areas of decks over occupied space shall have an additional capacity of 50 psf to accommodate suspended ceilings, lighting, ductwork, sprinklers, etc. Roof areas used for parking should have an additional 30 psf for snow loading.

C. The designed structural capacity of all floor levels and structural systems, including equipment support, shall be noted on the drawings. Include a “Column Schedule,” showing column loading arrayed according to floor and foundation elevations shall be included.

D. Load bearing masonry walls and piers shall specifically note the minimum bearing capacity, as well as noting any lateral loading, in psf required of construction.

E. Concrete is the preferred roof deck material. All roof decks shall be designed and built with a positive slope to drain locations in excess of one quarter (1/4) inch per foot. Unless the roof level is intended for future build-out as an occupied floor, the slope shall be provided by the structure. As an exception, positive slope may be provided by tapered foam glass insulation at crickets and around equipment pads. Poured gypsum roof decking shall not be used.

F. At the Design Development Phase, an experienced professional structural engineer shall inform the University concerning the following:

1. Flexibility in future remodeling and/or limitations on adaptive re-use.
2. Possible fatigue and maintenance inherent in long-term, post twenty (20) and forty (40) year utilization.
3. Durability and other considerations relevant to institutional use.

10.6 Foundations:

A. At commencement of design, the principal structural engineer shall review the requirements of the building program, configuration and dimensions of the site, and geotechnical investigation of subsurface conditions. The University has employed both spread footings and deep foundations to meet the needs of the program relative to such requirements as flexibility for future reconfiguration of use and for vibration control, and characteristics of the site such as ground water and proximity of adjacent structures. If one system is not clearly indicated and multiple foundation systems are applicable, the alternative systems shall be presented in an engineering study with the submittal of the Schematic Design Phase documentation. Such study of foundation alternatives shall include the desirable and undesirable aspects of each proposed system relative to program and site requirements, budget estimates, anticipated market forces at the scheduled period of construction and the impact on the project schedule.
B. The A/E contract for services shall determine if design and documentation of a separate phase of construction for foundations is required. In this event, foundation documents shall not be issued for construction prior to completion of 50% Construction Document Phase for the superstructure and, at least firm determination of the requirements of utility services, superstructure, foundation waterproofing, and exterior façade profile. Any early foundation package that is issued for the project shall include architectural sections showing all components that are installed below grade. Exceptions; shall be approved in writing by the University.
C. Cast-in-place foundation concrete, unless required by the design engineer to be a higher psi, shall not be less than 3,500 psi Foundation concrete normally includes spread footings & grade beams.
D. Cast-in-place concrete for caissons, augured cast piles and pile caps and walls shall not be less than 4,000 psi unless otherwise required by the design engineer to be of a higher psi.
E. Specify that spread footings, pile caps, etc. may be earth formed only if the sides are stable, true, and solid and free of old foundation or construction rubble and debris. Otherwise, they must be installed using formwork in compliance with the latest A.C.I. standards. In any case the material under the footing and sloped from it must be solid undisturbed earth, rock, etc.

10.7 Floor Slabs:

A. Flatness/Levelness: All concrete slabs on grade or elevated on metal deck or as reinforced cast-in-place concrete shall meet the A.C.I. minimum standards for Flatness/Levelness as follows:

1. Slabs on Grade: Composite flatness shall be no less than thirty five (35) with the composite levelness of not less than twenty five (25).
2. Elevated or Suspended Slabs: Composite flatness shall be no less than thirty (30) with the composite levelness of not less than twenty (20) class two (2) or three (3).
3. Slabs in Garages, Mechanical/Electrical or Non-Public Areas: Slabs in these areas shall not be less than twenty five (25) for composite flatness and twenty (20) for composite levelness.
4. These minimum standards shall be met unless required by UMB to be higher.

B. On Grade: All building floor slabs on compacted fill and gravel shall be a minimum of five (5) inches thick over an eight (8) mil vapor barrier. All wire reinforcement or rebar shall be supported using manufactured metal chairs designed for such purpose. The use of brick, rubble, or other materials shall not be permitted. The use of fiberglass or nylon reinforcement mat shall not be permitted.
C. Heavy weight interior cast-in-place concrete slabs on grade shall not be less than 3,500 psi with a low W/C ratio not exceeding 0.56, unless otherwise required to be at a higher psi for mechanical/electrical equipment, abrasive conditions, or heavy loads. If it is a loading dock area use a min of 4,000 psi air entrained min. 4% to 6%. Do not design any piping or conduit within slabs on grade. All such items shall be designed below the drainage fill.
D. Above Grade: All building floor slabs above grade shall be at a minimum of four (4) inches thick. All wire reinforcement or rebar shall be supported using manufactured metal chairs designed for such purpose. The use of brick, rubble, or other materials shall not be permitted. The use of fiberglass or nylon reinforcement mat shall not be permitted.
E. Lightweight cast-in-place concrete placed over a metal form or composite metal form deck shall not be less than 4,000 psi with a low w/c ratio of .56%. All lightweight concrete shall be 110-pcf +/- 3 pcf.
F. Slope all floors to drains where provided.
G. Levelness and flatness tolerance for floor slabs shall be clearly specified.
H. Control joints shall be provided for a maximum of nine hundred (900) square feet of floor area.
I. Exterior Slabs: All exterior slabs or hard surfaces abutting the building shall slope away from the building at a slope of one quarter (1/4) inch to twelve (12) inches.
J. Exterior concrete slabs for sidewalks, driveways, curbs, etc. shall be a min. of 3,500 psi air entrained cast-in-place concrete with a min. 4% to 6% air. Within Baltimore City the city does not normally allow reinforcing within general sidewalk or curb areas. There are of course some exceptions especially within concrete driveway aprons, heavy equipment support areas of over a deep fill area adjoining structures. All concrete must be placed over a compacted sub-grade and on a rolled and tamped four (4) inch min drainage fill.

10.8 Parking Structures And Other Wet Area Locations:

A. Parking structures require specialized experience in design and of new garages and in the investigation of existing structures not addressed fully in these Design Standards. The structural engineer engaged for the design and/or analysis of garage structures shall have demonstrable long-time experience in garage design.
B. The design and construction of garages requires specialized methods and experience. Except as otherwise justified by an A/E and/or builder experienced in multi-level parking structures, and approved by UMB, the University minimum requirements for service requires that all structural design include the following:

    1. Live loading shall be as defined in these Deign Standards.
    2. All structures shall be concrete with a minimum strength of 5,000 psi of low water/cement ratio. Microsilica aggregate shall be used at all floor structures, deletion of this additive in certain circumstances where all reinforcing is epoxy coated, shall only be allowed with the approval of UMB.

3. DCI additives shall be provided for façade panels to decrease the graying of the concrete.
4. Fiber reinforcing shall be utilized in topping slabs and slabs on grade.
5. Reinforcing shall be epoxy coated and shall be placed with a covering of twice the ACI recommendation for conventional structures.
6. Shear connectors, plates and fasteners shall be stainless steel. In certain circumstances, such as in stair towers not exposed to exterior elements, hot-dipped galvanized connectors and plates may be used, as approved by UMB, or in accordance with requirements of the project program. Steel angles for expansion joints shall not be used.
7. Traffic deck coatings shall be installed on supported floors and curbs in accordance with requirements of the project program, or as directed by the University. Garage slabs on grade shall be sealed in accordance with the project program.
8. Whenever placing concrete over precast joints whether within stairs or over any precast double tee, inverted tee or at a wall or spandrel do not place a tar paper strip or any other material that would inhibit bonding between the precast and the cast-in-place concrete. Install closed cell backer rods within the open joints with an adhesive polyurethane. Over all joints install a crack control joint per A.C.I. recommendations and install a self-leveling polyurethane sealant over.

C. Within garages the precast tee structures shall normally be designed for not less than a 50 psf live load plus dead loading and have a deflection not exceeding L/360.

   1. When a precast/cast-in-place structure is installed over office areas, mechanical/electrical rooms, etc., the live loading shall not be less than 100 psf plus dead loading, including suspended ceilings, with a deflection not exceeding L/750.
   2. If the structure over has a roof supporting mechanical/electrical equipment, then comply with min.150 psf live loading within equipment areas plus the 30 psf snow plus dead loads. If the space below includes an office space, include loading for structural supported mechanical and ceiling.

D. The sill heights at all elevators within garages and wet area conditions must be at least one (1) inch higher than the elevator lobby floor areas. The floor area in front of the elevators must be sloped away from the elevator sills in compliance with ADA maximum permissible slopes for drainage. Provide a non-slip surface to the floor. If within a garage or wet area use a non-slip traffic deck coating.
E. If the elevator lobby area is partly enclosed provide proper slope of water drainage out of the lobby area. Water ponding shall not be permitted within such areas. If the elevator lobby is located adjacent to an exterior open wall area when wind driven precipitation may enter in and around the elevator shaft, provide wind panels, a wing wall, etc. to protect both patrons and the elevator equipment. Water shall not be allowed to enter the elevator shaft or pit.
F. If the elevators are within a wet and/or corrosive environmental area specify #4 brushed stainless steel jambs, doors, and interior front elevator panels. Sills shall be heavy duty non-corrosive nickel/bronze alloy.

G. At garage or wet area stair entry/exit doors the floor elevation at and under any threshold must be at least one (1) inch higher than the adjoining floor outside of the stair door. The floor outside of the stair door must slope away from the door in compliance with ADA. There shall be no ponding water in or around the stair door and the floor surface must be made non-slip. Use traffic deck coating within corrosive garage areas.
H. ADA compliant aluminum thresholds shall be used at all stair doors. They shall be set in a full bed of polyurethane sealant. Install combination vinyl weather sweeps and rain-drips at door bottoms set in sealant. Install perimeter weather-stripping and rain-caps at frame heads set in sealant. If a garage interior stair door is anywhere near the exterior walls where wind-driven rain can penetrate a door, include wind panels for protection.

10.9 Existing Structures:

A. Concrete Structures: When existing concrete structures are selected for renovation, the existing structure shall be surveyed to identify its current condition. The investigation shall visually examine all elements of the structure. If the initial examination indicates possible deterioration, further examination shall determine the capacity and/or safety of the system, including such areas as the subsurface examination of foundations, creep deflection, and connections which may require core drilling, petrographic analysis and/or load testing for capacity, soundings, and x-ray or magnetic examination for location of reinforcing steel and/or other devices. The structural engineer engaged for such examinations shall have demonstrable long-time experience in forensic analysis.
B. Steel Structures: When existing steel structures are selected for renovation or when replacement of infrastructure equipment is required, the structure shall be surveyed for current condition and compliance with the requirements of this part for new construction. The structural engineer, engaged for such examinations, shall be registered in the State of Maryland, and have demonstrable long-time experience in forensic analysis.

10.10 Structural Steel Framing:

A. All structural steel design shall be in accordance with the building codes listed herein as well as any specific requirements of the project program for equipment for the future. All loads (dead and live) used for design shall be indicated in the construction documents, both drawings and specifications. A graphic column schedule indicating the design loading for all columns shall be indicated in the structural drawings.
B. Floor loadings shall be as described in these Design Standards.
C. Flat roofs shall have a minimum slope of one quarter (1/4) inch in twelve (12) inches.
D. Special conditions of the program shall be considered, including vibration control, durability of the building or structure relative to special environmental exposure(s), and impact and fatigue loads that may exist in the structure.
E. Connections: Loads used in the design of major structural components, including connections, shall be shown on the construction drawings. The A/E shall be responsible for the design of all connections and shall review and approve the design and detailing of all connections submitted by the fabricator. All connection design and details shall bear the seal of the responsible registered professional structural engineer licensed in the State of Maryland.

F. Steel Framing for Mechanical and Electrical Systems: The structural steel design shall include all structural steel components, details, elevations, and sections required to support horizontal and vertical pipe and conduit systems in the project. Coordinate requirements with the Architect and MEP Engineer.
G. Steel Framing for Mechanical and Electrical Equipment: The structural steel design shall include all structural steel components, details, elevations, and sections required to support mechanical and electrical equipment and related piping and conduits elevated above the finished grade and/or finished roof level in the project. Where equipment also requires elevated maintenance platforms see requirements in See Chapter 19: Mechanical Design General Requirements and Chapter 23: Electrical Design General Requirements and coordinate with Architect and MEP Engineer.

10.11 Cold Formed Metal Framing:

A. When exterior load bearing steel and stud brick and/or stone veneer walls are considered in lieu of masonry back up initiate a discussion with UMB and their review staff to discuss options and rationale. The following standards shall apply:

1. Comply with AISI specifications when calculating characteristics of cold formed metal framing. Use AISI's “Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members". Comply also to the Center for Cold-Formed Steel Structures (CCFSS) technical bulletin, Vol 2 No. I February 1993, and "AISI Specification Provisions for Screw Connections".
2. Welded connections are not desired because of the resulting damage caused to the galvanized surfaces. If welded connections are permitted, they must all be cleaned and coated with a Galv-a-weld protective coating material.
3. Design the framing systems to withstand design loads without deflections greater than L/750 of the unsupported wall height for all masonry veneer walls and L/360 for exterior walls receiving an exterior "EFIS"-type insulation and high performance coating system.
4. Design framing system to provide for movement of framing members without damage or over stressing of sheathing, connections, or veneer.

10.12 Metal Fabrication:

A. All steel, including fasteners, plates, etc., related to this Chapter which are exposed to exterior weather conditions, located in wet areas or mechanical and electrical equipment rooms, or within exterior wall construction used to support masonry and/or insulated panel skin, etc. are to be fabricated and finished with hot-dipped galvanized coatings.
B. Examples shall include, but not be limited to the following:

1. Ladders, including ships ladders, railings, etc.
2. Catwalks including stairs up to them, gratings, plates, rails, etc.
3. Roof top or penthouse and mechanical equipment grillage steel.
4. Loose steel lintels.
5. Shelf and relieving angles.
6. Overhead door steel channel and angle support frames.
7. Loading dock edge angles.
8. Exterior corner guard.
9. Pipe and wheel guards.

10. Pipe bollards.

C. Rooftop or penthouse and mechanical equipment grillage steel.

10.13 Miscellaneous Metals:

A. Metal Studs:

1. Specify all metal stud types, size, minimum three and five eighths (3 5/8) inch or six (6) inch, and spaced at sixteen (16) inches on center in compliance with the latest edition of the National Gypsum Company Construction Guide Manual.

B. Service and Receiving Areas:

1. Bollards, and steel angles or channels shall be designed for all service and receiving areas to protect the building from damage. All exterior miscellaneous steel shall be hot dip galvanized.

10.14 Design Coordination:

A. Coordinate the placement and detailing of all structural members with the requirements for all other disciplines, including elevators, plumbing, HVAC, electrical, and architectural systems.
B. The A/E shall make site visits sufficient to ensure that no detail of existing conditions is omitted from either the design or the contract documents.

10.15 Construction Documents:

A. As indicated below the construction documents shall also include the following:

1. The construction documents shall clearly indicate all special erection procedures necessary; including required temporary bracing.
2. Special conditions and/or requirements shall be designed and clearly indicated on the construction drawings; a general cover-all statement in the Specification shall not be considered sufficient to define the work.
3. For exterior brick and stone facades, in particular, the location and dimensioning of supporting angles is of particular importance. Notes and detailed dimensions shall be included in large scale three (3) inches = one (1) foot – zero (0) inches plans, sections, and details. Details that show only the exterior profile shall not be considered sufficient information by the A/E to adequately describe the design intent to the fabricator and installer.

End of Chapter

Chapter 11: Building Exterior Design

Updated November 20, 2024

11.1 Building Exterior Design:

A. Exterior building and site improvement design shall comply with the current Urban Design Guidelines defined in the UMB Facilities Master Plan and as described in these Design Standards. The strategic goal of campus design is to consistently improve an evolving environment using predominantly regional materials and sustainable design strategies to enhance the physical campus environment.

B. The UMB Facilities Master Plan uses established common elements among its buildings to define its architectural character. These elements are identified as:

1. Volumetric massing, façade organization and plan layout based in rationally derived geometric composition, rather than of freeform or referential composition for construction feasibility.
2. A load-bearing masonry character established by a minimum two-thirds of the façade area being surfaced by brick and stone. Avoid using masonry in non-load bearing, or in-fill panelized elements to defining character and mass. Since 1991, design guidelines have recommended articulation of the facades as a base, middle, and top.
3. Predominant use of standard-sized red/pink brick, with a moderate range, original to Maryland and Baltimore (but not necessarily manufactured in Maryland).
4. Use of smooth surfaced buff-colored stone for trim and design detailing, or as a base for composition of the facades. Both buff-colored Indiana limestone and detailed architectural precast concrete have been used satisfactorily. Precast concrete lacks the variation found in natural stone. The use of manufactured stone should continue to be used as large pieces similar to those of limestone, rather than as smaller unit masonry sizes, and should simulate the variety in color found in natural stone.
5. Windows and entrances are commonly oriented vertically or articulated as such by frame and mullion design with brick or stone heads and sills. A single color for frames and windows has not been established campus-wide. Window frames are predominantly of the same color in localized areas of the campus. The color and material of new or replacement window frames, louvers, and trim shall match existing for renovation projects.
6. Mitigate large expanses of a single material in the façade composition by elements that provide human scale. Metal curtain wall or glass spandrels should be composed of multiple elements and contained within a predominately masonry context. Curtain window wall construction is not typical as the dominant façade treatment and should be limited to feature panels when included in the design. Large expanses of masonry without windows should be avoided or subdivided by masonry trim or other device.
7. Buildings shall be designed with a single main entrance as feasible. The main entrance should be apparent and emphasized in major buildings by the design of the facade. Entrance lobbies should be transparent to the street or building approach to inhabit the immediate outdoor space. Weather vestibules are required by energy code. Locate a security station immediately inside the interior door. The main entrance shall be accessible and equipped with ADA-compliant mechanical

operators. Positive storm water drainage shall be provided away from all entrances and exits. Emergency exit-only doors typically do not have exterior hardware and should not be emphasized as an entrance in the façade composition. Non-public service areas and/or equipment should be screened or otherwise not emphasized.

8. Building name and address signage shall be accommodated clearly in the building design in accordance with University signage standards. Schematic Design Phase and Design Development Phase elevations shall indicate the proposed building identification signage.

11.2 Precast Concrete:

A. Architectural Precast Concrete: Architectural precast concrete used in lieu of Indiana Limestone for exterior façade panels shall have a simulated limestone finish and shall have a face mix that includes fine aggregate to achieve a sugar cube appearance. Exterior precast concrete units (including load-bearing spandrels and columns) for parking structures shall be fabricated by a plant certified by the Precast Concrete Institute (PCI) for group A-1, and the American Precast Association (APA).

B. Architectural Plant Cast Concrete: Architectural plant cast concrete shall comply with the guidelines regarding structural design and fabrication as defined by the Precast Concrete Institute (PCI) and the American Precast Association (APA).

C. Color: Plant and structural architectural concrete color shall match Indiana Oolitic limestone as quarried in Lawrence, Monroe and Owen Counties, Indiana" grade and standard buff with sand rubbed finish.

D. All Architectural Precast Concrete shall be designed by a qualified registered professional structural engineer.

E. Precast Concrete Mock-up: The A/E team shall require a mock-up for the precast concrete assembly. The mock-up shall be a minimum of four (4) feet x four (4) feet or larger as necessary to demonstrate the quality of the workmanship and materials used. The specifications shall include the requirement that the manufacturer of the precast assembly shall demonstrate the ability to make repairs to a damaged panel that results in an acceptable finish quality.

11.3 Unit Masonry

A. Exterior Architectural Materials: To support the University's goal of building a campus setting which represents its strategic values, the masonry materials used shall be selected by the following guidelines and in accordance with the technical requirements defined herein. The Master Plan require the use of Indiana Limestone on the first floor of new buildings and a predominance of "indigenous red-pink" brick throughout the remainder of the facades unless an existing condition should recommend otherwise. Other materials shall not be used without written request and specific approval of the University for reasons of technological necessity, a sustainable desire for singular identity by a particular organization, or to match a significant adjacent building, etc.

1. The materials and details employed for weather-proof construction shall be proven, low-maintenance systems with a service expectancy of at least forty (40) years. While state-of-the-art functions in the facility or budgetary and/or schedule limits may suggest the use of the newest technology under development, the exterior expression of these should be found in dependable, time-tested construction. Facades erected as temporary enclosures in anticipation of a future addition may be designed for removal, but it shall be constructed of a good quality "permanent"

material, such as a simplified brick detailing, and should not appear to be "temporary" as often the building's use is extended for years.

B. Acceptable Brick and Mortar:

1. Brick and mortar shall be standard-sized face brick with necessary custom shapes, of a red through-body color set in a running or common bond with natural sand-colored mortar similar to the appearance of Davidge Hall. The University, as a public agency, has not selected a proprietary brick. However, recent construction on the campus exhibits a number of acceptable products that meet these criteria including:

   a. Health Sciences Facility 1:

      i. Brick: Glen-Gary "Alwine Maryland blend," selected range
      ii. Mortar: Leigh #00351
      iii. Mortar Color: Indiana Limestone "buff" color

   b. Campus Center

      i. Brick: Cushwa 50-50 blend of 327 Cambridge and 115 Shenandoah
      ii. Mortar: Flamingo 223
      iii. Mortar Color: Pre-case Limestone match

   c. School of Nursing Addition

      i. Brick: Glen-Gary "Lafayette"
      ii. Mortar: Riverton R-73
      iii. Mortar Color: Pre-cast Concrete Limestone match

C. Brick Unit Masonry

1. Face Brick: Unless otherwise required to match an existing condition as directed by UMB, brick units shall conform to ASTM C216, standard size [two and one quarter (2 1/4) inch x three and five eighths (3 5/8) inch x eight (8) inch], grade SW, 5500 min. psi average minimum compressive strength or greater unless otherwise required by the University to match existing conditions. Brick shall be full-bodied, generally smooth textured with no added surface film color other than lightly flashed. A light sand finish may be provided for softness texture. It shall be type FBS. Brick units shall be standard size [two and one quarter (2 1/4) inch x three and five eighths (3 5/8) inch x eight (8) inch],
2. Units: Specify units without cores or frogs and with exposed surfaces finished for ends of sills, caps and similar applications that would otherwise be exposed.
3. Shapes: Specify special shapes for headers or stretcher units used at corners, movement joints, bond beams, sashes, lintels, relief angles, brick projections, etc. Saw cutting will not be permitted where exposed to view outside a wall face. Projected brick trim etc. shall have a sloped top edge to shed water. A mortar cap or wash is unacceptable.
4. Color: The face brick color and texture; unless required to match existing, shall be selected by the A/E, and reviewed and approved by UMB. Refer to the schedule of recent projects for acceptable brick/mortar color combinations. The A/E shall select and specify two bricks or brick blends, to be supplied by different brick suppliers to provide a competitive bidding environment. Specify that a four (4) foot x

four (4) foot mock-up of each proposed brick shall be provided for review and approval by the A/E and the University prior to bidding of the brick work.

D. Concrete Unit Masonry:

1. Concrete masonry units shall comply with ASTM C90 with a minimum compressive strength 1,900 psi. Weight classifications shall be as required by code and design requirements. Do not specify aggregates made from pumice, scoria, or tuff. Specify Type I, moisture controlled units.
2. Concrete masonry units exposed to exterior conditions shall include an integral water repellant using a liquid polymeric, integral water-repellant admixture that does not reduce flexural bond strength. Specify that the units containing the additive shall be tested according to ASTM E 514 with the test period extended to twenty four (24) hours, and they shall show no visible water or leaks on the back of the test specimen.

E. Stone Veneer and Trim:

1. Indiana limestone veneer and/or trim shall be used in areas as recommended in the UMB Master Plan, and as required by the architectural design. Stone trim units shall be of Indiana Oolitic limestone as quarried in Lawrence, Monroe and Owen counties, Indiana, and shall comply with ASTM C568, category II conidium density grade and color standard buff. Specify a Sand-rubbed finish to match stone as utilized in recent projects.
2. Natural granite shall be utilized in the first course under Indiana Limestone veneer as protection from deterioration by penetration of water-borne salts. The granite shall be dimensioned the same as the full thickness of the limestone veneer. If granite is utilized as door sill's, specify a surface finish which is not slippery when wet. Specify mortar and/or sealant color to match granite in this course rather than Limestone above.

F. Cast Stone:

1. Cast stone may be furnished in lieu of buff colored Indiana Limestone, as provided in the program, or as approved by the Office of Facilities Management. Where architectural pre-cast concrete will not provide the shapes, color, sharp edges, or profiles desired by the A/E, Cast Stone may be specified and shall be fabricated by a plant certified by the APA for Vibra dry-tamp cast stone.

G. Mortar and Grout Materials:

1. Specify face brick and stone to be set with a type N integrally-colored mortar complying with ASTM C270.
2. Existing masonry requiring restoration work shall be repaired according to Brick Institute of America (BIA) Technical Bulletin 7. In accordance with Bulletin 7, samples of the existing mortar shall be removed and analyzed for composition, strength, and mortar color as the basis for the specification of the new/replacement material. Portland cement based mortar, which is stronger than adjacent masonry, shall not be used; specify a mortar that is weaker than the existing mortar, and not stronger than type 'M.' For soft old joints, use type 'O.' All joints to be repointed shall be raked out at least three quarter (3/4) inch deep or until a solid surface is found, without mechanical saw cutting, and prepared clean and square to the

masonry. Joints shall be repointed to the full depth of the joint according to BIA recommended procedures; surface repointing is not acceptable. Prepare specifications accordingly.

H. Masonry Construction Details:

1. Contract Drawings: Contract drawings shall include the following information related to Unit Masonry:
    a. Fire resistance rating which must be achieved (four (4) hour, three (3) hour, etc.), if any.
    b. Extent of each type of engineered and empirically designed masonry and delineate, as required, to show dimension (nominal thickness, cavity width, setting bed thickness, etc.) and construction (single wythe, multi-wythe, composite, cavity, etc.).
    c. Structural requirements coordinated with ACI 530 and ACI 530.1. Latter standards require masonry compressive strengths (psi) of masonry to be placed on drawings.
    d. Indicate structural bonding between wythes (continuous wire reinforcing) and space of reinforcing, anchors, etc., as well as the extent of insulation in cavity walls and hollow units. Lintels shall be detailed and cross referenced to structural drawings as scheduled.
    e. Details at masonry openings for doors and windows (sill, jamb & head conditions) shall be drawn at a scale of three (3) inch = one (1) foot – zero (0) inch and show all adjacent components of the assembly.
    f. Location, types, and details of items to be built into masonry, such as flashing, drip flashings, weeps, damp proofing, mortar net, reglets, polymer mesh wrap around columns, and insulation nailers.
    g. Location of movement joints and details of each type of movement joint. Show isolation joints between masonry and concrete, and masonry and steel framing, if any. Indicate all remolded joint material, backer rods and sealant at the detail.
    h. Details of special bearing areas (particularly for hollow unit masonry) showing extent and type of high-strength units, such as solid CMU areas in hollow CMU walls, vertical and horizontal reinforcement grout or concrete fill for hollow CMU, bond beams, and other special construction required for structural bearing.
    i. Architectural design elements shall clearly delineate pattern bonds for exposed surfaces, if other than running bond, areas of colored mortar and type, details of special features such as recesses, offsets, and/or special coursing, etc.
2. Horizontal Joint Reinforcement: Specify truss type in single-wythe masonry walls, “ladder” type for multi-wythe cavity masonry walls. At exterior multi-wythe cavity walls use truss type at interior wythe with integral adjustable rectangular exterior wythe ties. Space continuous horizontal wall reinforcing sixteen
3. At exterior face of interior wythe of masonry cavity walls specify a damp proof coating. Damp proofing should coat structure as well.
4. Construction specifications shall specifically require the use of mortar boards during construction and back troweling of mortar onto rear of exterior wythe. Head joints must be filled solid.

5. Specify vertical wall expansion joints approx. thirty (30) feet – zero (0) inches on center and horizontal expansion joints under all relief angles and rigid structural elements per BIA recommendations. Incorporate remolded full depth closed cell neoprene expansion joint material with backer rod and sealant over. Sealant color shall match mortar color unless otherwise required by the designer at adjoining materials.
6. In areas subject to vandalism or defacement at brick or stone masonry include an application of a silicone elastomer as a graffiti control measure, in the specifications.
7. Contract specification "boiler plate" requirements for masonry construction shall be coordinated with requirements of the drawings for clear, unmitigated direction.
8. Architectural details shall clearly indicate the locations of all anchors, ties, reinforcing, joint reinforcement, lintels, insulation, chases, recesses, or openings for other construction for each type of masonry construction included in the project.

I. Roofscapes: When the design includes the location of equipment on the roof level, an enclosed penthouse shall be given priority over roof-mounted equipment screened from view. Roof-mounted equipment shall be screened by substantial material consistent with the design of the building and shall be effective in concealing the equipment from major campus view corridors. The location and placement of roof-mounted equipment shall be consolidated and organized for an orderly appearance and for maintenance of both the equipment and the roof.

J. The potential for green roof installations shall be analyzed for the benefits of insulation, mitigation of the urban heat sink effect, and storm water run-off control.

End of Chapter

Chapter 12: Wood, Plastics, and Composites

Updated November 19, 2024

12.1 Wood, Plastics, and Composites

A. Standards for Wood and Plastics:

1. Wood: Architectural woodwork shall comply with the Standards of the Architectural Woodwork Institute (AWI) for premium grade or custom grade woodwork. Economy grade work is not acceptable except as may be specifically approved, by item, by UMB.
2. Plastics: Plastic laminate finished work shall be in accordance with AWI (American Woodwork Institute) standards for custom or premium grade for self-edge or solid wood-edge laminate veneer, and as required herein for countertop, construction. Economy grade work is not acceptable except as may be specifically approved, by item, by UMB.
3. Particleboard: Particleboard is not permitted for use in any application for carpentry, including cabinets, carpentry, countertops, and sheathing.

12.2 Rough Carpentry:

A. Treated lumber shall be specified to be used in damp areas, and when in contact with concrete, masonry, plaster, and when used as roof blocking. Material shall be kiln-dried to a maximum 15% for plywood and 19% for lumber moisture content after treatment. Brush coat all cuts with same preservative. All framing lumber shall be marked for type, grade, mill, and grading agency identification.

12.3 Interior Finish Carpentry

A. Generally, wood is not used for interior finishes in new construction on the UMB campus. Exceptions are in the use of wood trim as paneling in Lobbies, specific rooms with public use, elevator cabs to match lobbies, and for handrails. Wood flooring has not been used and is discouraged. Proposed exceptions, such as general wood casing at doors and baseboards, wainscoting, ceiling panels, etc. shall be presented to UMB for determination of appropriateness. The proposed use should support requirement(s) of the program.
B. Restoration of existing structures, particularly those of historical nature, may require the replacement of deteriorated wood elements in kind. Such work must comply with current code requirements for fireproofing, hazardous materials abatement, and use of pressure-treated decay- resistant woods within masonry or damp conditions. Replacement work should replicate existing profiles and construction.

12.4 Interior Architectural Woodwork:

A. Drawings and details shall clearly define each type of interior architectural woodwork so that it is distinguished from carpentry and other types of woodwork.
B. Where more than one grade of woodwork is included in the design clearly identify each grade of wood.
C. Grade of Woodwork: AWI standards recognize three grades of quality: premium, custom, and economy. Generally:

1. Premium grade requires the best grade of finish materials and workmanship currently recognized. Premium grade might be specified for woodwork throughout

an entire building, but it should not be specified indiscriminately. Premium should usually be specified only for selected areas or selected items that have particular architectural significance or use/durability requirements- for example public use lobbies, conference rooms, lounges, special offices or rooms, or as designated by UMB or as specified in the project program.

2. Custom grade is the accepted standards for public and institutional work, in both material and workmanship requirements. Executed with the strictest compliance with AWI, it is the standard of University work, and has been effectively used in classrooms, labs, offices, etc.
3. AWI Type of Cabinet Construction: reveal overlay for standard custom grade laboratory (casework) wood cabinets.
4. Economy grade has been found to be not sufficiently durable for long-term, public institutional use. It is not recommended for use except in projects of established limited use such as temporary relocations, etc., as approved by UMB.

D. Substantial cost differences exist between the different grades, finishes, and, for casework, different types of cabinet construction. Also, transparent finished woodwork generally is more expensive than woodwork with an opaque finish, depending not only on the species and cut of wood selected but also on the type of finish required. Consequently, determination of quality grade should be based on a careful study of design role, function, location, and finish of each woodwork item.
E. Drawings, details, and elevations shall include dimensions for all elements of work including profiles of jambs, trim work, moldings, and any specialized joinery.
F. Fire Retardant Treatment: Usually, small amounts of architectural woodwork are permitted for most occupancies and spaces without requiring fire-retardant treatment. However, for many applications where woodwork (of any type) is extensive, such treatment of all or part may be required or advisable. However, use of fire-retardant wood limits choices available with respect to material and thickness as well as to treatments and finishes, particularly transparent finishes. Where fire-retardant-treated woodwork is required by Code or the University, specify a Class “A” flame spread rated vinyl polyester or varnish intumescent clear coat for stained finishes, and intumescent vinyl for opaque finishes.
G. Where fire retardant treated wood is included in the design, clearly identify the location, size, dimensions, etc.
H. Include in the specifications all non-wood materials to be furnished in the work, such as glass doors, shelving, grommets, wire ways, etc. Devices to be incorporated in the work but furnished by other trades shall be coordinated and clearly noted, such as manufactured cabinet inserts, sinks, plumbing, heating elements, lighting fixtures, electrical and signal devices, etc.

End of Chapter

Chapter 13: Building Envelope, Thermal and Moisture Protection

Last Update: 11-19-2024

13.1 Scope:

A. This part outlines the recommended or required products for the building envelope, roofing, and waterproofing. For exterior masonry see Chapter 8 – Structural Design.

13.2 UMB Overview:

A. The integrity of the entire weather protection systems of University buildings must be given first priority for both new and existing buildings. Most University buildings house extraordinarily expensive equipment and irreplaceable research work, and all buildings have year-round activities that cannot be disrupted due to exterior building damage or water infiltration. Compounded by the number of buildings, even normal maintenance is a significant expense for the University. Therefore, only the most durable and dependable systems must be provided, including the roofing system, roof drainage systems, exterior wall assembly and exterior doors.

13.3 Guarantee And Warranty:

A. The first two (2) years of warranties on all-weather protection systems will be covered by the contractor, under the University General Conditions. Extended warranties by system manufacturers for specialty components or systems, shall be from year three through to the end of the specified warranty period.
B. All roofing systems must be warranted for no less than twenty (20) years and include a no-dollar-limit (NDL). Included shall be the roofing membranes, insulation, felts, edge metals, flashings, and flashing tie-ins, and shall be guaranteed and warranted as a total system. Copings shall be included in the NDL total warranty on a case-by-case basis.

13.4 Thermal And Moisture Protection:

A. Roofing- General: The Maryland Board of Public Works policy on roofing requires that the design of all new construction include a sixty (60) year life cycle analysis to determine the recommended system. In general, the system shall meet or exceed the minimum requirements for fire rating under the type of construction selected for the entire building, except as specific functions or equipment should require a greater rating. The roofing system shall meet or exceed FM 1-90 for wind uplift.
B. Roof slope to drains shall be a minimum of one half (1/2) inch per foot. The preferred roof slope should be incorporated into the design of the structure; otherwise, the slope may be achieved by tapered insulation. Roof design shall provide for the gravity removal of all standing water from the roof within a forty eight (48) hour period, and conditions which could cause snow drifting or ice buildup should be avoided.
C. Uncurbed penetrations through the roof, particularly pitch pockets, shall be avoided in the design. If pitch pockets are an unavoidable necessity, these should be round. Prior approval for the use of pitch pockets must be obtained from UMB.
D. Roof Access: The A/E shall include provisions for easy access to all roof areas.
    1. The use of portable lift conveyances and portable ladders is not considered easy access.
    2. The top flight of stairs to the roof may be considered not a public-use stair and should be gated off with a keyed lock. The top flight is preferred to be an extension

of the stair in terms of riser and tread dimensions, but may be a steeper flight that complies with OSHA regulations for a Utility Stair if approved by UMB. For roof access to a level that contains an elevator machine room, the rise and run must be NFPA compliant.

E. Thermal Insulation:

1. Slab on Grade Design: Specify as a minimum a two (2) inch thick x twenty four (24) inch wide extruded Styrofoam insulation board with a minimum compressive strength of 15 lb/in^2 and an aged "R" Value of five (5.0) per inch.
2. Foundation Walls: At Foundation Walls (supporting back fill) specify as a minimum two (2) inch thick extruded Styrofoam channel grooved drainage insulation board over a water proofing membrane. Insulation board shall have a minimum compressive strength of 25 lb/in^2 and an aged "R" Value of five (5.0) per inch.
3. Exterior Masonry Cavity Walls: Within exterior masonry cavity walls specify as a minimum two (2) inch thick extruded Styrofoam rigid plastic insulation board with a minimum compressive strength of fifteen (15) lb/in^2 and an aged "R" Value of five (5.0) per inch.
4. Within exterior masonry veneer/metal stud cavity walls over gypsum sheathing specify as a minimum one (1) inch thick extruded Styrofoam rigid plastic insulation board with a minimum compressive strength of fifteen (15) lb/in^2 and an aged "R" Value of five (5.0) per inch.
5. At exterior masonry veneer/metal stud walls between framing specify as a minimum six and one quarter (6-1/4) inch thick R-19 foil faced fiberglass insulation.
6. Within fire rated gypsum shaft wall assemblies enclosing elevators, mechanical rooms, utility shafts, stairs, etc. specify as a minimum full cavity depth thickness thermal fiber SAFB insulation to meet the UL assembly requirements.
7. At sound rated gypsum/metal stud partitions around offices, conference rooms, etc. specify full cavity depth thickness x full height unfaced fiberglass batt insulation unless directed otherwise by UMB.
8. Under all air intake and/or exhaust air plenum slab areas as a minimum specify a four (4) inch thick three (3.0) lb/ft^2 density rigid FRK (foil faced) fiberglass insulation board with a minimum "R" Value of seventeen point four (17.4) and extend twelve (12) inches beyond the perimeter of the plenum. The A/E shall review and calculate each condition and increase the "R" Value or extend the insulation to prevent condensation from forming on the underside of the plenum slabs.
9. Where mechanical and electrical rooms, with heat and noise generating equipment, are located below occupied spaces as a minimum specify a three and one half (3-1/2) inch thick three (3.0) lb/ft^2 density rigid ASJ (white reflective faced) fiberglass insulation board with a minimum "R" Value of fifteen point two (15.2) to the underside of the structural deck. The A/E shall verify that the "R" Value of fifteen point two (15.2) is sufficient to reduce the noise and offset the heat transfer. If not, the insulation thickness shall be increased.
10. Where mechanical and electrical rooms, with heat and noise generating equipment, are located above occupied spaces as a minimum specify a two and one half (2-1/2) inch thick three (3.0) lb/ft^2 density rigid unfaced fiberglass insulation to the underside of the structural deck. The A/E shall verify that the two and one half (2-1/2) inch thick insulation is sufficient to reduce the noise and offset the heat transfer. If not, the insulation thickness shall be increased.

13.5 Mechanical Room Water Proofing:

A. Specify a polyurethane waterproof coating system, suitable for pedestrian traffic and the removal/replacement of mechanical and /or electrical equipment, complying with ASTM C957-91 or latest edition and having a Class 'A' fire rating on concrete substrates. The specified system shall contain no volatile organic content (VOC's). Color can be selected from the standard color range.
B. As a basis of design specify a Vulkem 350/351 NF waterproof coating system by Tremco, Inc. or approved equal with the following accessories:

1. Primer as recommended by the coating system manufacturer.
2. Closed cell, polyurethane joint backing rod as recommended by the manufacturer.
3. Aggregate with a forty (40) to fifty (50) mesh silica sand; local aggregate approved by the coating manufacturer.
4. Vulkem 922/227 sealant or approved equal as recommended by the coating manufacturer.

C. Foundation Water Proofing: The A/E team shall investigate the specific conditions of the proposed site and recommend the appropriate foundation water proofing system. The A/E team shall conduct a foundation water proofing study and submit their findings at the SD phase. The recommended approach shall be a system that has a proven track record of successful applications for projects with similar site conditions and anticipated ground water conditions. The A/E team shall specify that the foundation water proofing shall have a warrantee period of at least ten (10) years for materials and installation.

13.6 Exterior Finish And Insulation System (EFIS):

A. Use of an exterior finish and insulation system (EFIS) as an exterior building material requires specific approval by UMB. In any case, EFIS shall not be used at grade, with in ten (10) feet above grade, or in other locations which may be susceptible to damage.
B. Where an EFIS system is approved for use by UMB, specify a system that includes all board insulation, reinforcing fabric, base and finish materials, fasteners, trim accessories, and sealants that are compatible with one another and approved for use by the system manufacturer.

13.7 Roofing System:

A. Roof Membrane System for New Installations: The use of single membrane systems is discouraged by UMB. Specify a modified bitumen roof membrane system with petroleum-based primers and mastics, cap flashings, roofing felts, insulation, trim accessories, and walking pads that are compatible with one another and approved for use by the roofing system manufacturer. A hot applied system is preferred.

B. Roof Membrane System for Re-roofing of Existing Buildings: When projects require re-roofing, either as a complete project or as part of a building renovation project, the A/E team shall survey the existing site, make note of all existing conditions, locate all vent pipes, steel supports, fans, ducts, conduit, and all other roof penetrations, and include all items on the construction drawings. For re-roofing of an unoccupied building, specify the roof membrane system to be as described in the previous paragraph for new installations. For re-roofing of an occupied building, specify the roof membrane system to be as described in the previous paragraph, with the exception that it be installed using the cold application system. The construction documents shall include all temporary roofing systems necessary to keep the building water tight during the contract period and prior to final acceptance of the new installation.
C. Surfacing: A white mineral surfaced cap sheet shall be specified as part of the roofing system and shall be a compatible with and approved for use by the roofing system manufacturer.
D. Roof Insulation: Roof insulation shall be specified to be part of the complete roofing system and shall be included in the roofing system warrantee. The roof insulation shall be rigid high-thermal closed cell polyisocyanurate insulation board with a universal black fiberglass-reinforced mat on both sides as recommended by the roofing system manufacturer for compatibility and suitability for the application. The insulation thickness shall be as necessary to achieve an overall average minimum insulating value for the roofing system assembly of R-30, or greater if required for the desired thermal performance of the building or to meet code requirements. The A/E team shall use the aged R-value of the insulating materials when calculating compliance with the requirements of this paragraph. Specify the installation of the insulation material to be in two (2) layers with staggered joints. The A/E team shall specify that the first layer of insulation board shall be hot mopped to a primed concrete surface, in accordance with the requirements of the roofing system manufacturer. Specify to taper the insulation if required to achieve slopes to drain points. At no point in the system shall be insulation be less than two inches in thickness. Specify that after the installation of the roof insulation layers, a quarter (1/4) inch thick glass-mat water resistant gypsum substrate cover board equal to Dens-Deck Prime by Georgia Pacific Corporation be installed, with materials and installation method as compatible with the roofing system manufacturer.
E. Wood Blocking: Specify that all wood blocking shall be exterior grade treated for moisture resistance and in accordance with the roofing system manufacturer’s requirements.

F. Sheet Metal Flashing and Trim: The A/E team shall include details for sheet metal flashing and trim in the construction documents. The details shall comply with the latest edition of the "Architectural Sheet Metal Manual" of the Sheet Metal Manual and Air Conditioning Contractors National Association. AISI Type 302/304 stainless steel in compliance with ASTM 167, 2D annealed finish, 28 gauge minimum is the preferred material for flashing and trim. Copper and aluminum materials of appropriate gauge and quality may be considered in certain circumstances but shall not be specified without prior authorization from UMB. Through-wall and counter flashing shall be specified to be receiver type to permit re-roofing. Flashings shall be specified to be locked and soldered at seams and corners. Flashings at roof penetrations, curbs, and transitions shall be specified to extend up a minimum of eight (8) inches above the surface of the roof, and to the bottom of counter flashings. All flashing designs and details shall comply with the requirements of the specified roofing system manufacturer. All flashing details shall be designed to eliminate the need for sealants, and sealants and caulking shall not be relied upon for water tightness.

G. Copings: UMB prefers the use of precast concrete or cap stone copings in lieu of metal coping systems.

H. Projects involving disturbance of the existing roofing system: For renovation or equipment replacement projects that involve removal or disturbance of a portion of an existing roofing system to accommodate the installation of new equipment support curbs, posts, piping and/or ducts through the roof, or other roof penetrations, the A/E team shall include in the construction documents the name of the manufacturer and local representative of the existing roofing system. The A/E team shall include the requirement that all work related to the roofing system shall be performed by the roofing system manufacturer's authorized representative that holds responsibility for maintaining the existing warranty, using materials that are compatible with the existing roofing system. UMB will provide to the A/E team the information on the existing roofing system and terms of the existing warranty.

I. Installation of Equipment on New or Existing Roofing System: Where the project design includes the installation of equipment on new or existing roofing systems, the design shall include installations that involve the minimum number of roof penetrations for support and to route pipes, ducts, conduit, and wiring to the equipment. Where possible, the use of existing penetrations shall be used, and support from existing nearby structures and steel dunnage shall be investigated. It is always preferable to penetrate vertical surfaces, such as penthouse walls over creating new roof penetrations. Where penetrations through the roofing system are necessary for equipment support or for routing of services, UMB prefers the use of equipment support curbs and pipe curbs. To facilitate re-roofing efforts in the future, all supports shall be designed to install equipment and ductwork a minimum of thirty six (36) inches above the finished roof surface, or greater if necessary due to their size. No equipment shall be located within six (6) feet of any roof drain. All equipment shall be located such that service access dimensions are at least ten feet from all roof edges or boundaries. The A/E team shall orient the long dimensions of equipment and skylights to be parallel with the roof slope to avoid creating obstructions to rainwater flow. The use of crickets should be considered where necessary to facilitate the flow of rainwater around obstructions and equipment.

J. Walkways and Pads: Walkways shall be clearly identified on the roof plans to indicate all necessary paths to equipment requiring periodic service and maintenance, and to provide access to access doors, hatches, ladders, stairs, and other access points. The specified walk pads, and their installation, shall be compatible with the roofing system manufacturer.

K. Accessories: All roofing accessories shall be specified to be compatible with the materials and installation methods of the roofing system manufacturer.

L. Roof Drains: Roof drains shall be designed in accordance the requirements of See Chapter 19: Mechanical Design General Requirements of these Design Standards. UMB prefers the design of internal drainage systems in lieu of external gutter and downspout systems. The sizing and spacing of roof drains shall be designed to prevent ponding and shall not exceed forty (40) feet between roof drains. Drain locations shall be symmetrical to simplify insulation tapering. The roof drains shall be designed to be installed in sumps no smaller than four (4) foot x four (4) foot to facilitate proper drainage.

M. Safety Barriers:

1. New Construction: For new construction projects, early in the design process (SD or DD Phase) the A/E team shall investigate and recommend a permanent perimeter safety railing system for the roof level that satisfies OSHA requirements. Acceptable safety barriers include a parapet wall or a permanent perimeter railing system of sufficient height to satisfy OSHA requirements (Code of Federal Regulations, Title 29 {Labor}, Part 1910 {Occupational Safety and Health Standards}, Subpart D {Waking Working Surfaces}, Section .29 {Fall Protection Systems and Falling Object Protection-Criteria and Practices}). Safety railing systems shall be permanent.
2. Renovation Projects: For renovation projects that includes either roof and/or major equipment replacements, the A/E team shall investigate and recommend a permanent perimeter safety railing system that satisfies OSHA requirements early in the design process (SD or DD Phase) for all roof levels that do not currently have such a system. Where existing building roof levels include a warning line type safety barrier this type of system must be replaced with a permanent perimeter safety rail system. Where existing roof levels do not have a safety barrier include a new permanent perimeter safety rail system as part of the project.
3. Unacceptable Railing Safety Systems: Safety railing systems that are not acceptable to UMB and will not be permitted under any circumstances include the following barrier types:

    a. Barriers requiring assembly or erection prior to roof access.
    b. Warning line systems.
    c. Systems requiring safety harness and tethering.

N. Roofing System Protection: The A/E team shall include requirements in the specifications for protection of the existing and new roofing systems during construction. The construction documents shall include provisions for storing and moving materials and equipment over the roof in such a way as to prevent damage to the roofing system. The construction documents shall include the requirement for the performance of an infrared scan of the existing roofing system prior to commencement of work on the roof to record pre-construction conditions, and a second infrared scan at completion of work to confirm that no damage has occurred.

13.8 Fire Stops And Smoke Seals

A. UMB requires all fire stop and smoke seal materials for all trades to be provided by one manufacturer.
B. Specify fire stops and smoke seals for both new and renovation projects for all penetrations through rated assemblies, by ductwork, piping systems, electrical conduit, cable trays, architectural and structural components, etc., to maintain the rating of each assembly. Also specify that the fire stop and smoke seal material manufacturer's representative shall train the personnel of each trade on the proper installation methods. The manufacturer's representative shall also supervise the installation of the fire stop and smoke seal materials to assure compliance with the manufactures installation instructions to obtain the desired assembly rating.
C. Where insulation is used as part of the smoke and or firestopping specify a semi refractory fiber board safing board insulation designed for use as a fire stop at gaps and openings in walls, edges, slabs, shaft walls, etc. to meet the UL requirements for the assembly. Specified safing insulation shall be manufactured from combing semi-refractory mineral fiber manufactured from slag with thermosetting resin binders to comply with ASTM C 612, Class 1 and 2; normal density of four (4) lb/ft2 passing ASTM E 136 for combustion characteristics, "R" value of four (4) at 750F (23.90C).

End of Chapter

Chapter 14: Openings

Last Update: 11-19-2024

14.1 Exterior Doors:

A. General: All exterior doors, frames and hardware shall comply with these Design Standards to ensure a reliable level of quality, appearance, and operation. To minimize door weight the height of exterior doors shall be limited to eight (8) feet. Designs that include oversized doors are highly discouraged by the University. The architect must obtain written approval from UMB to include oversized doors in the project.
B. Main Entry Doors: Power operated doors shall not be considered, unless approved by UMB for ADA consideration. Specify magnetic lock sets when used in conjunction with card readers. Mechanical lock sets shall not be used.
C. Door Closures: Include in the specifications, the contractor shall balance the closures to meet ADA and code requirements.
D. Security: Security requirements shall be as directed by the Department of Public Safety and the Fire Marshall in the Department of Environmental Health and Safety.
E. Life Safety: Exit doors must always allow free egress, including loss of power or failure of the access control system. Requiring a person to read a sign or perform another action (ex. Pull a fire alarm) or wait a period (ex. Time delayed exit) is unacceptable.
F. Finishes: Exterior doors and frames shall be painted galvanized steel or anodized aluminum as appropriate for the design. Where required by the architectural style of the building, solid wood panel doors may be acceptable for certain projects and /or in historical buildings.
G. Equipment Room Doors: Exterior doors to mechanical and electrical rooms shall be of adequate size to accommodate the installation and or removal of equipment.
H. Hardware: For door hardware requirements see Interior Doors Hardware and Security

14.2 Exterior Windows:

A. General: All exterior windows, frames and hardware shall comply with these UMB Design Standards to ensure a reliable level of quality, appearance, and operation.
B. Finishes: Window frames are almost universally extruded aluminum sections. Finishes are typically either anodized or hard-coat.
C. Glazing: Glazing shall be clear glass panes, low - E treated, double-glazed with a ten (10) year guaranteed vacuum-seal. Opaque finishes for spandrel glass panels shall be back-coated, commonly on the fourth surface or as recommended by the manufacturer.
D. Sash Type: Most windows are fixed in response to requirements for controlled environments. The use of operating sash is limited and must be approved by the Office of Facilities Management. However, with the commitment to green building design practices and LEED™ Silver Certification UMB is open to consideration of operable windows as part of a natural ventilation system and as needed for reducing mechanical HVAC energy use in a controlled operation.
E. Replacement and Replication: Replacement of existing windows in historic structures shall replicate those removed, utilizing clear, low-E double glazed panes if possible. Standards for other window replacement projects shall be determined on a case-by-case basis with discussions with UMB.

F. Weather Test: Include in the specifications the following requirement, “Exterior windows and masonry openings shall be weather tested using the Voluntary Specification for Field Testing of Windows and Sliding Doors (AAMA 502-02) test method B.

14.3 Exterior Architectural Woodwork:

A. General: Wood is not used on the exterior of new construction on the UMB campus. Proposed exceptions, such as the use of wood exterior doors, screens or shutters shall be presented to UMB for determination of appropriateness.
B. Framing: Similarly, the use of structural wood framing shall not be employed without an approved exception by UMB and the UMB Fire Marshal.
C. Restoration and Replacement: Restoration of existing structures, particularly those of an historical nature, may require the replacement of deteriorated wood elements in kind. Such work must comply with current Code requirements for fireproofing, hazardous materials abatement, and use of pressure-treated decay-resistant woods within masonry or damp conditions. Replacement work should replicate existing profiles and construction.

14.4 Interior Doors:

A. General: All interior doors, frames and hardware shall comply with these UMB Design Standards to ensure a reliable level of quality, appearance, and operation.
B. Security: Security requirements shall be as directed by the Department of Public Safety and the Fire Marshall in the Department of Environmental Health and Safety.
C. Life Safety: Interior doors in the path of egress must always allow free egress, including loss of power or failure of the access control system. Requiring a person to read a sign or perform another action (ex. Pull a fire alarm) or wait a period (ex. Time delayed exit) is unacceptable.
D. Finishes: Interior doors to be plain sliced red oak veneer, grade ‘A’ select, book matched, slip matched, or balanced matched with a natural finish. For existing building, match the building standard, which may include painted doors or other veneers such as maple or rift cut red oak.
E. Interior Door Openings: Door openings to toilet rooms, dressing rooms, or other private areas shall be located so as to block direct views into the rooms. Doors opening to toilet rooms shall be push/pull type, not latching or locking.
F. 081213 Hollow Metal Frames - Interior Door Frames: Interior door frames shall be specified as face welded, dressed, and ground smooth hollow metal, 16 gauge at openings up to and including forty eight (48) inch width. For openings over forty eight (48) inches wide specify 14 gauge frames. For special locations, such as Animal Facilities and exterior doors, frames shall be fully (continuous) welded.
G. 081416 Flush Wood Doors - Interior Doors: Interior doors shall be specified as one and three quarter (1-3/4) inch structural composite core, premium grade. Provide vision lights and “half door” tempered glass view windows as appropriate, match the building standard exactly and provide profile detail. For fire-rated doors, specify continuous top blocking and lock block.
H. Equipment Room Doors: Doors to mechanical and electrical rooms shall be of adequate size to accommodate the installation and or removal of equipment.

14.5 087100 Door Hardware:

A. UMB Hardware Systems: UMB, through the O&M lock shop, is required to maintain, repair, and interchange many locks, cylinders, exit devices, and assorted other items of finish hardware on an ongoing basis. To maximize the value and economics of a standardized hardware system, it is necessary that proprietary specifications be instituted for selected hardware items; thus, the specific items listed herein are to be considered mandatory. The A/E shall coordinate the finish hardware schedule with UMB.

B. Locks: Mortise lock shall be used as a standard of quality for all projects. Cylinder locks shall be used only when upgrading an existing door or matching a building standard. Lock sets shall be as follows:

1. Mortise Locksets: Specify Yale 8800 FL series, AVR trim design and 2196-6 cylinder. For existing buildings, match building standard for lever choice.
2. Cylinder Lock Sets: Specify Yale 5400 LN series, AU trim design and 1210 core. Cylinder lockset may only be specified when approved by the University or to match adjacent hardware.
3. Cylinders and Keying: Provide Yale Large-Format (LFIC), 1210- 626 LA six (6) pin removable core cylinders with a 2221 housing and two keys for every lock, keyed to an LA keyway. Furnish construction cylinders and keying for use during the construction period. Permanent cores shall be delivered to the UMB PM for final keying and installation by UMB Lock Shop upon completion of the project. Keys shall be round head, with no engraving except “LA” for the keyway.
4. Manual Closers: Provide LCN 4040XP. All closers to be mounted on the non-public side of the door.
5. Hinges: Provide 5 knuckle heavyweight NRP ball bearing hinges, use stainless steel at exterior locations and at Animal Facilities.
6. Combination Locksets: Provide Simplex Pushbutton Mortise Lock Yale/Medeco LR8146M-26D-41 for new installations or modifications to existing mortise lock. Kaba Lever Yale/Medeco (less core) L1021M-26D-41 or R1021M-26D-41 for new only.
7. Exit Devices: Provide Von Duprin 99 Series (grooved) Lever Trim. Provide keyed cylinder dogging. Use thin profile 33 series at narrow stile metal doors.
8. Shelter in Place Exit Devices (at rooms with large gathering): Provide manual thumb turn with security indicators on inside of door.

C. Exterior Door Hardware: For exterior door hardware include the following in the specifications:

1. Surface mounted closures are to be mounted on the inside of the door.
2. Provide continuous geared hinges, Roton type, concealed. Inground pivot hinges are not acceptable unless approved by the University.
3. Inground pivot hinges are not acceptable on exterior doors.

D. 087113 Automatic Door Operators: Automatic door operators shall be Stanley Magic Access or Stanley Magic Force for high traffic areas. The operator shall be finished to match the door frame in high profile public areas like building lobbies or reception areas. Other acceptable product: Besam SW200i.

14.6 Door Entry Security

A. Reference Chapter 26: Fire Alarm, Safety, and Security Systems Design. Coordinate door entry security and with the campus-wide access control system and any related design elements with all pertinent disciplines.
B. Electric Hardware: For doors that require electric hardware:
    1. Do not provide electric strikes.
    2. Provide electric latches in door leaf with a request-to-exit relay.
    3. Provide surface-mounted door loops (not power transfer hinges) for interconnecting electric latch with the door frame. Keep exposed portion of the loop within six (6) inches of the top of the door.
    4. Electrified Openings: Doors shall be pre-wired with enough concealed wires to accommodate electric function of specified hardware. Provide Molex type standardized plug in connectors to accommodate up to twelve wires.
C. Stairwell and Fire Command Areas:
    1. For doors at stairwell exits and fire command centers, provide card reader with electric mortise lock. Provide for continuous locking, except when the fire alarm system releases the lock.
D. Path of Egress:
    1. For doors along the path of egress requirements, coordinate with UMB for any specific fire alarm system integration or manual release requirements.
E. Double Doors:
    1. Both door leaves are to be operable in double doors with latches symmetrical in appearance. For locations in non-public areas where in-active leaves are desirable do not provide trim on inside and outside.
F. Door Contacts:
    1. Door contacts are to be provided; provide contacts for both leaves on double doors

14.7 087113 Automatic Door Operators-

A. For doors also requiring auto-operators:
    1. Push plate shall be brushed #4 stainless steel with blue engraved lettering on a recessed back box.
    2. Push plates shall include a double pole double throw (DPDT) momentary-type relay output. Unit shall be hardwired back to the automatic door operator.
    3. Provide a MS Sedco ‘Time Delay Module’ Model # TDM for sequencing the auto operator with the electric latch.
B. For interlocking doors without auto operators:
    1. The University will use opposite doors’ door contact output(s) for interlocking. Do not provide any additional “sequencers,” solid- state or microprocessor timers, PLC’s, etc.
C. For interlocking doors with auto-operators, include the following additional requirements
    1. The University will use the opposite doors’ contact outputs for interlocking.

2. Provide push plates with a pneumatic time delay DPDT output capability and a time delay range of two (2) to sixty (60) seconds.
3. Provide an MS Sedco 'Time Delay Module" Model # TDM for sequencing the auto operator with the electric latch. Provide the TDM for each leaf.

D. Exterior doors designated as emergency exit only, require the following:

1. No exterior hardware to prevent use of hardware as leverage for a pry tool.
2. Magnetic locks for strength.
3. Door contacts for an open door alarm interconnected with the card access system shall be alarmed both local and at remote location.

E. Comply with ADA requirements when specifying frames and doors including:

1. Push/pull resistance requirements including negative air spaces.
2. Minimum door opening with latch side clearances.
3. Appropriate accessible hardware.
4. Upon completion of installation of door and hardware, the contractor shall do a final adjustment and balancing of all door closers and test the door force(s) in the presence of the Owner.
5. Special considerations for push/pull forces may need to be addressed at exterior doors and at stairwell doors. Coordinate with UMB.

End of Chapter

Chapter 15: Finishes

Updated December 9, 2024

15.1 Interior Design:

A. The University has not established formal standards for the design of interior spaces and their finishes, except as defined in these Design Standards. A common level of finish is prevalent across campus, with specific requirements added by each School and Administrative Units. A consistency that is familiar among the schools and units, and one that can be commonly maintained, is encouraged and appears to have been adopted by consensus. These materials are thought to be appropriate to the institution's image and means as a public institution for professional education, and as defined in this document.
B. Because the University employs design consultants with acknowledged functional expertise, as well as knowledge of the practices among its peers and industry trends, it is anticipated that A/E's will provide interior designs that are neither complicated, elaborate, insubstantial, nor inadequate.

15.2 Acoustical Standards:

A. Basis of Standard: The building design shall provide for well-controlled acoustical environments as appropriate for professional education, advanced research, personal consultation, and health care facilities. The design shall utilize buffer spaces, such as storage rooms, corridors, and toilet rooms, to provide acoustic and vibration separation between sources of noise and occupied spaces. Walls surrounding mechanical equipment rooms shall be masonry to assist in sound attenuation.
B. Special functions as indicated in the project program may require detailed analysis by a professional acoustical engineer or as a result of particulars of the building design. The A/E shall advise the University concerning application of HIPAA standards of confidentiality and the ANSI Standard for classroom performance as guidelines. The University customarily has tolerated sound intrusion from external sources such as rotor impulse along the Medivac helicopter flight paths, emergency vehicle sirens and vibration from city busses, though changing expectations of building performance may require reduction of these intrusions.
C. The following requirements for acoustical design are primarily based on the control of airborne sound, but attention should be given to the control of structure-borne transmission as well:

    1. Noise Coefficient: The Noise Coefficient (NC) rating of ambient, or background, sound within an area shall not exceed an NC 30 - 35 in the range of 63 to 8,000 Hz with a reverberation time of approximately 0.5 seconds.
    2. Sound Transmission: Sound Transmission Coefficient (STC) ratings for reduction of sound transmission in party walls, floors and ceilings between spaces generally shall be in the range of 40 -55 dB. The lower rating is applicable to separation of classrooms and corridors; the upper rating is applicable for isolating offices requiring confidentiality. A rating of 35 dB may be acceptable for separation between faculty and administration offices or for amplified sound in a lecture hall to a common lobby. A rating of 60 dB. may be required for isolation of patient treatment areas or other requirements related to HIPAA. Movable partitions between office cubicles should be rated as STC 24 if sixty (60) inches high.

3. Noise Reduction Coefficient: Materials for sound absorption and attenuation shall achieve an NRC of .70 and CAC of 35 - 40 in the mid frequencies of 750 - 4000 Hz. Generally, the University relies upon the performance of lay-in acoustical tiles in this range, supplemented by carpet where practical for increased reduction. Special conditions may indicate the use of acoustical batts above partitions or hard ceilings. Wall-mounted soft absorptive panels should be utilized only in special conditions approved by the UMB Project Manager.
4. Specify acoustical ceiling tiles for a .75 NRC (min. of 35 CAC).

15.3 092900 Gypsum Wall Board Assemblies:

A. Standard Gypsum Board Partitions:

1. Generally, and unless specifically required otherwise, provide standard partitions constructed of five eighths (5/8) inch gypsum wall board mounted on three and five eighth (3- 5/8) inch x 20 gauge metal studs at sixteen (16) inches on center.

    a. Acoustical insulation may be specified (scheduled) for above described "standard" partition, as function requires.

2. Metal Plate Reinforcing: Specify or indicate horizontal galvanized plate(s) six (6) inch width x 16 gauge x length required (in maximum unit lengths of eight (8) feet each), screw or rivet-attached to face(s) of metal studs in gypsum board partitions, to provide reinforced backing for fastening cabinet, counters, shelving units and other wall-mounted items. Coordinate plans and identify locations, extent, and height to center-line of plate(s) throughout.
3. Include access panels and/or doors for all concealed mechanical/electrical equipment requiring maintenance (i.e., ballasts, valves, HVAC controls, etc.)
4. Wood blocking shall not be included in the design of metal stud walls.

B. The following rooms and spaces are generally expected to have partitions up to the underside of the deck above:

1. All fire, smoke, and/or acoustically treated partitions
2. Lobbies,
3. Corridors,
4. Conference rooms,
5. X-ray rooms,
6. MRI rooms,
7. Electron microscope rooms,
8. Laboratory research rooms,
9. Animal facilities,
10. Dark rooms,
11. Mechanical, electrical, and communication rooms,
12. Utility shaft walls,
13. Private offices and interview rooms where required by the program
14. Any room without a ceiling.

C. Where partitions are intended to be used as railing enclosures around balconies, stairs, etc. these partitions shall be designed, certified, and detailed by a structural engineer to withstand the horizontal and vertical loads as required by code for railings. Studs and tracks shall be specified to be a minimum of 16 gauge with attachment clips designed for the loads.

15.4 093013 Ceramic Tile

A. General: Ceramic tile includes both glazed and unglazed tiles, mortar and grout, trim pieces, etc. used on walls and/or floors in public areas to satisfy the requirements of the project program, or as directed by the University.

B. Toilet Room Floor Tile:

1. Two inch x two inch thin set tile. Furnish cove base and bull nose inside and outside corners and cap. Mortar color: charcoal grey.
2. Large-scale tile has begun to be widely used at UMB. Provide for 1/8 inch mortar joints.

C. Wall and Wainscot Tile:

1. Sized to coordinate with floor tile using thin set method. Specify the appropriate mortar color for the wall tile. White may be used.

D. Thresholds:

1. Furnish marble thresholds at entrance to rooms with ceramic tile floors. Thresholds shall have proper taper to conform to ADA standards.

E. Attic Stock: Provide attic stock of each type of ceramic tile. Coordinate quantities with UMB.

15.5 095113 Acoustic Panel Ceilings

A. Campus Standards:

1. Public spaces, offices, class rooms, laboratories

a. white faced acoustic ceiling panels with a complete metal suspension system.

i. 24 inch x 48 inch x 3/4 inch,
ii. 24 inch x 24 inch x 5/8 inch or thickness required to achieve acoustical performance.

2. Computer rooms, animal areas, clean rooms

a. Non Perforated Vinyl Faced Panels: Armstrong Clean Room Mylar (1716).

i. Borders and tiles requiring cuts within the tile are to be vinyl-glued per manufacturers instructions

b. Aluminum Suspension Grid

i. 15/16 inch white aluminum with based aluminum coating

c. Narrow profile grid systems are not allowed.

B. Acoustic ceiling panel style standard is square cut lay in or angled tegular, style.

1. Match building standard, or specify

a. Fine Fissured by Armstrong or approved equal by USG or Certainteed.
b. Ultima by Armstrong or approved equal by USG or Certainteed
c. Provide tile with NRC and CAC that meet the minimum requirements for the program space.

C. Attic Stock: Attic stock only required for special acoustic ceiling panels. Coordinate quantities with UMB.

15.6 096500 Resilient Flooring

A. General: UMB will only accept premium commercial grade resilient flooring. Resilient flooring includes vinyl composition tile (VCT), solid vinyl tiles, vinyl sheet goods and related accessories.
B. Indicate on drawings the following information related to resilient flooring:

1. Location and extent of each type of resilient flooring, special patterns, borders, and cutouts.
2. Location, extent, and junction details of accessories, as required.
3. Special details of installation, as required.
4. Schedule of sizes, types, colors, and patterns on a room-by-room basis.
5. Indicate direction of grain; note no quarter (1/4) turn, unless directed by UMB.

C. Attic Stock: For each type, color, pattern, and size installed, UMB requires

1. 5% attic stock for projects under one thousand (1,000) square feet
2. 2% attic stock for projects one thousand (1,000) square feet and above

D. Size:

1. VCT

a. twelve (12) inch x twelve (12) inch x one eighth (1/8) inch.

2. Vinyl tile

a. eighteen (18) inch x eighteen (18) inch x one eighth (1/8) inch.

3. Vinyl sheet goods

a. six (6) foot x eighty (80) feet to one hundred ten(110) feet x 0.080 gauge.

E. Approved Manufacturers

1. Armstrong,
2. Tarkett,
3. Toli,
4. Congoleum,
5. Amtico International,
6. Other approved equals.

F. Underlayments

1. Specify underlayments over existing wood floors or subfloors as one eighth (1/8) inch to one quarter (1/4) inch Luan plywood.
2. Masonite is not acceptable.

G. Vinyl transition strips/reducer

1. One eighth (1/8) inch or one quarter (1/4) inch gauge; color: black or brown.

H. For all renovations, specify that the contractor shall be responsible for removing and disposing of all tile, underlayment to be replaced, cove base and transition strips.

15.7 096513 Resilient Base and Accessories.

A. Thermoplastic Rubber base, with preformed inside and outside corners.
B. Use cove base at vinyl floor tile, and toeless or cove base at carpet.
C. UMB color preference is generally dark, black, brown tan or gray.
D. Provide for a mock-up to verify workmanship at inside and outside corners.
E. Use rubber carpet edge for glue-down applications, nosing for carpet, reducer strip for resilient floor covering, joiner for tile to carpet transition strip.

15.8 096800 Carpet

A. Carpet shall be selected based on use, user, durability, serviceability, replacement accessibility, sustainability, and appearance. Both carpet tile and broadloom carpet are established standards at the University.
B. 096813 Carpet Tiles

1. Carpet tiles with high performance fibers and moisture-barrier backing may be specified for general purpose carpeting, and can be used in all areas such as lobbies, corridors, auditoriums, offices, and class rooms.
2. Preferred Manufacturers:

a. Interface
b. Tarkett
c. Bentley
d. Mannington

C. 096816 Sheet Carpeting - Broadloom Carpet – HP/MB

1. Broadloom carpet with high performance (HP) and moisture barrier (MB) backing system may be specified in all areas with light, moderate and heavy traffic areas.
2. Preferred Manufacturers:

a. Tarkett
b. Mannington
c. Bentley

D. Carpet Exclusions: Carpet shall not be used in server rooms or rooms with sensitive electronic equipment.
E. Cleaning Procedure: The University uses hot water soak and extraction cleaning.
F. Attic Stock: For each type, color, pattern, and size installed, UMB requires

1. Carpet Tile: 10% of the installed total square footage
2. Broadloom Carpet: 5% of the installed total square footage

G. Design Considerations:

1. Long corridors shall not be railroaded (twelve (12) foot, twelve (12) foot) unless the carpet pattern is of such a nature that the seams will not be noticed. Approval shall be through UMB.

2. The carpet selections for entrance level areas and elevator lobbies must be carefully considered. Consider borders and smaller sections of carpet, so target periodic replacement is cost effective.

H. Warranty Requirements: Include the following in the project specifications:

1. Warranty Performance Requirements: Specify that the contractor shall provide a five (5) year extended written warranty, co-executed by the installing subcontractor, agreeing to repair, replace, reset, or re-stretch carpeting that fails in installation materials or workmanship within the specified warranty period. In addition to others available for selected carpet, the following manufacturer product warranties are required:

a. Against surface pile abrasive wear (fiber loss) in excess of 10% for a period of ten (10) years.
b. Ten (10) year antistatic warranty.
c. Backing delamination – Lifetime
d. Edge unraveling and zippering – Lifetime

I. Glue: All carpet (carpet tile, broadloom) to be direct glued unless otherwise approved by the UMB Project Manager

1. Adhesives: Specify only adhesives recommended by the manufacturer of the selected carpet.

J. All carpet shall have an ASTM 648 Class 1 fire rating.
K. All carpet shall have less than 3.0 kilovolts of static at 700F and 20% humidify.
L. All carpet types shall be either loop or cut and loop type. Cut pile carpeting may be used in conference rooms, in borders, or in special locations as approved by the University.
M. Yarn: Unless an exemption is approved by the University, specify that all carpet shall be made of the following:

1. Yarn Dyed: DuPont Antron or Lumena Nylon.
2. Solution Dyed: DuPont 6.6 fiber.

N. Specify that the carpet construction shall be type'6.6' nylon pile with a minimal face weight of twenty (20) oz. to a maximum thirty six (36) oz. Dye method shall be solution dyed, combination solution/yarn dyed or yarn dyed as appropriate for the project.

15.9 099123 Interior Painting

A. Paint Type: Many factors must be considered in selecting between flat and gloss sheen, between a latex and an alkyd oil paint. The following factors must be considered prior to specifying a paint finish:

1. Substrate material and surface.
2. Function and environment of the area to be finished.
3. Texture and gloss desired.
4. Washability/durability desired.
5. Abrasion resistant properties required.
6. Chemical resistance necessary.
7. Color hue and value desired.

B. Recommended Finishes

1. Offices and Corridors:
    a. Velvet Acrylic: eggshell
    b. Acrylic Latex: eggshell
2. Stairwells, Gypsum Wall Board, CMU Walls, and/or U/S Stairs:
    a. Latex: semi-gloss
3. Classrooms:
    a. Velvet Acrylic: eggshell
    b. Latex: semi-gloss
    c. Benjamin Moore: Ultra Spec Scuff-X Eggshell
4. Wet Laboratories:
    a. Latex: eggshell
5. Animal Research Facilities:
    a. Acrylic: acrylic epoxy, single component modified when directed, MPI 115.
6. Rest Rooms:
    a. Latex: semi-gloss or satin
7. Janitor's Closets:
    a. Latex: semi-gloss
    b. Splash Zone: provide FRP on splash zone behind sink.
8. Wood Door and Wood Frame:
    a. Latex: semi-gloss
9. Metal Door and Window Frame:
    a. Latex: semi-gloss
10. Mechanical, Electrical and/or Data Rooms:
    a. Silthane II by Insl-X: floors only, MPI 60.
11. Exposed Piping in Stair Wells and/or Other Finished Areas:
    a. Direct to metal, MPI 153.
12. Exposed Ductwork in Finished Areas Only:
    a. Latex: flat

C. Manufacturers, Quality Line

1. Specify paint materials as manufactured by Sherwin Williams or Benjamin Moore of the top quality line for each paint type.
    a. Colors: Specify manufacturer's standard colors.
    b. Light Reflectivity: minimum 60%; target of over 70% to comply with cost-effective lighting design.

End of Chapter

Chapter 16: Specialties

Updated September 19, 2024

16.1 101400 Signage - University Signage Design

A. Scope

1. This part outlines the minimum requirements for the design procedures for signage for new buildings, and repair and alteration projects for existing buildings on the University of Maryland, Baltimore (UMB) campus.
2. Provisions have been made to comply with accessibility standards and local codes.

B. University Signage Standards:

1. Exterior Signage and Wayfinding: The UMB Sign Master Plan prepared by Chermayeff & Geismar, February 2012 defines the campus-wide exterior signage. It is a comprehensive program that addresses pedestrian and vehicle wayfinding, and clearly identifies the campus community within downtown Baltimore. The A/E shall refer to, and abide by, the requirements and recommendations of the referenced Sign Master Plan for the design of campus-wide exterior signage.
2. The UMB Sign Master Plan applies to campus-wide exterior signage for institutional identification, wayfinding, parking facilities and other University Center district environmental identity initiatives but may require coordination on a project-by-project basis with Baltimore City for its “Pathfinder” landmarks system, and for traffic and transit management.
3. Other buildings and activities such as the University of Maryland Medical Center and the Veterans Affairs Medical Center have building-specific signage conventions that may, or may not, employ the UMB signage system as determined by need or convention within those institutions. All institutions that occupy the campus precinct area are encouraged to use the standards prescribed in the UMB Sign Master Plan.

C. 101400 - Interior Signage System:

1. The UMB Interior Signage System, prepared by the University of Maryland, Baltimore Design and Construction Department, July 2016, provides the design of a uniform system for all interior directories and space/use identification signage, and is to be used in all buildings and leased spaced within the purview of UMB. The Signage System is to be supplemented by signage required for operational and emergency procedures such as that required for safety warnings, legal notifications, emergency exits, equipment, and piping identification, etc., as defined by either the conventional practices of the UMB Division of Operations and Maintenance or by building code mandate.

D. Exterior Signage And Wayfinding:

1. Building Identification Sign: The building name and address shall be as established by the project program and/or as determined by the University. Building identification shall be in accordance with the UMB Sign Master Plan, either mounted on the face of the building near the entrance or on the prominent approach to the building.

2. Building Address: The street address of the building shall be in numerals large enough to read from the curb or at a fifty foot distance along an approach. The lettering style shall be Futura Book. A building address located on a glass transom over the entrance door shall be installed on the interior surface in bright silver leaf with a one eighth (1/8) inch black border. A building address may be located on a side lite only if a transom is not available. Otherwise, placement of the address in any location other than centered over the main entrance door is not in accordance with the standard expected by emergency response personnel.
3. Building Identification Pylon: Major facilities may be identified by a freestanding building name sign located in the brick paved area along the curb according to the UMB Sign Master Plan.
4. Banners: In addition to the required identification, a commonly used public facility, such as a clinic or auditorium, may be identified by a metal “banner” sign mounted on a campus lighting standard in accordance with the UMB Sign Master Plan.
5. Dimensional Lettering: Lettering shall be pin-mounted cast aluminum ribbon letters in an appropriate size. Clear anodized natural color aluminum letters have been used exclusively in the past, but black finished letters may be utilized as recommended by the A/E and approved by the University. Colored letters, including white or “dark bronze” previously approved, shall not be used. Cut plate letters shall not be used.
6. Names, Addresses, or Inscriptions: Names, addresses or inscriptions shall not be incised permanently into the masonry or metal fabric of the building unless approved by the University.
7. Decorative Signs: Should decorative signs or "Architectural Lettering", including banners or other impermanent devices, be proposed on the exterior of a building as integral to the design of the building, implementation shall be submitted to the University for review and approval as being acceptable within the intent of the UMB Sign Master Plan.
8. Plaques: Cast bronze plaques utilized as building identification prior to 1980 should be retained to add a layer of visual complexity that represents institutional longevity and history. However, if removal is recommended by the A/E, the proposed modification shall be submitted to the University for review and approval. If approved, the exposed wall and silhouette ghost shall be removed and restored to match adjacent material. New cast bronze plaques utilized for historical interpretation or commemoration shall be cast as one piece with polished letters on a dark oxidized field, finished with a light sandblast but not coated to render an antique appearance and accelerate aging. Brightly polished or gloss-coated plaques shall not be used.
9. Lighted Signs: Internally lighted signs or neon shall not be used for building identification and address signage. The UMB Sign Master Plan proposes that only “skyline” campus-wide identification may be lighted.

E. 101400 - Interior Signage Design Standards:

1. Current Signage Design Standard:

    a. Background: The diversification of signage designs permitted in the past resulted in an unmanageable range of background colors, inefficient and expensive fabrication technology, a weakening of institutional consistency, and

a style that had become dated. Consequently, with the opportunity offered by several large systems being installed within one year, as well as the introduction of a new campus-wide identity system using black as a field for colors from the state flag, a major change in the design of the interior signage system was adopted in January 2004. In this new updated sign system, specified in the UMB Master Specification, Section 101400- Interior Signage, the size, content, types of signs and placement are consistent with the previous system.

b. Current Signage Design Standard: The specification for construction and the color designations and formulae of the current sign design(s), for use when providing signage that is to match existing conditions at a building or in new construction of a building or large renovation, is specified in the UMB Master Specification, Section 101400- Interior Signage, The current sign design(s) is described in detail herein.

2. Interior Signage Scope Requirements:

   a. New signage is required within the scope of work for capital improvement and facilities renewal projects. The design of a new or substantially renovated building, and the renovation of an entire single floor or a large department, shall include a new system of signs within the scope of work for design and construction. In the event that a new system is located within an existing building, a determination must be made as to whether the new signs should comply with the background and text colors of signage existing in the building, or whether an updated format should be installed for coordination with anticipated future changes within the building. Typically, a change in color or design has not been made unless the extent of the system is significant enough to require an entirely new building directory. This determination shall be made in consultation with the University.

   b. Replacement signs are required on a continuing basis in varying quantities, ranging from a single name insert to updating signs for an entire area. Such new replacement signs shall match the existing signs in design, background color and text style. A project that includes the requirement for new signage shall also include the provision of inserts and any changes in the building and/or floor directories.

   c. Additional Interior Signage: Although every effort shall be made to maintain consistency throughout the campus, with the use of the UMB Interior Signage System, a gradual evolution within the systems has occurred because of new regulations, specific requirements of certain uses, changes in material availability and long-range changes in design trends, etc. Partial modifications of the system may be approved by UMB on a project-by-project basis as necessary to coordinate new requirements with the existing system.

F. Interior Signage Requirements (Current UMB Sign Standard):

1. Interior Graphic Images: The design of the graphic images for directories, room signs, special purpose signs, and other signs, shall consist of:

   a. Characters and symbols shall contrast with their background, achieved by a single brushed or matte silver-colored field with black text. Raised letters shall be all capital letters with braille, engraved letters may be initial capitalized. Both the characters and the background of the signs shall have a non-glare finish.

b. Except on directories which should be justified left with numbers justified right, all numbers and texts shall be centered.
c. All signs shall be frameless and corners shall be essentially square with a slightly eased edge (rather than sharp), in sizes as indicated in this section.
d. Large building directories may be fitted with a simple, one-line border frame to coordinate with the design of the lobby. The University of Maryland logo shall appear only on building directories and may appear on large conference rooms or auditoria used for public events.

2. Materials: Materials approved for signage fabrication includes:

   a. Base Material: One quarter (1/4) inch rigid, clear acrylic.

      i. Edges: Cut edges are not to be polished or painted.
      ii. Finish on back of sign base material: (only applicable for signs with insert windows): Screen printed or painted silver on back of one quarter (1/4) inch clear acrylic.

   b. Surface Overlay: Brushed plastic aluminum one sixteenth (1/16) inch thick two (2) ply micro-surfaced ABS with hardware protective surface, matte finish with black core. Item #H-391M (Manufactured by Innovative Plastics).
   c. Tactile Characters: One sixteenth (1/16) inch rigid, Rowmark ADA Black (#311-401). Type face for text shall be Futura Book ACCT,A.K.REV.F (Manufactured by Gerber Scientific for Omega Software). No other font is allowed. Raised characters are set into and chemically bonded into computer routed slots. The face of all characters shall be raised a minimum of one thirty second (1/32) inch from the surface of the sign.
   d. Braille: All tactile characters shall be accompanied by braille captions directly below; braille dots are set into the sign surface. Braille shall be “Grade II” conforming to specification #800, National Library Service, Library of Congress:
   e. Signs with Insert Windows (for room name or room occupant(s)): Where inserts are required, use three thirty second (3/32) inch thick cast acrylic laminated to .030 thick black rigid vinyl filler (which creates a one and one eighth (1-1/8) inch high window slot for a one (1) inch window), centered vertically. For larger inserts see illustrations for dimensions.
   f. Window Inserts for Room Identification: The insert shall be full width of the slot, with the text located on the insert to be centered on the window. The text size shall be three eighths (3/8) inches high and shall be The Sans Plain font type, a Microsoft Windows standard font. If the length of the name exceeds five (5) inch, then the size of the typeface should be reduced. Condensed text is not acceptable.
   g. Signs with Permanent Room Name (Type G):
   h. Mounting Tape: All signs suitable for wall mounting shall be provided with VHB adhesive for mounting.

3. Mounting: Mounting shall be consistent with ADA regulated clearances on the wall adjacent to the latch side of the door. Signs shall be mounted so that the bottom of the top text is sixty (60) inches above the finished floor or shall match mounting height of adjacent existing signs.
4. Sample: A sample of a typical interior room sign shall be submitted to the University for approval prior to fabrication of signs for all projects. Approved samples of signs

from past projects from fabricator, already on file with the University, shall be deemed acceptable for future projects.

5. Directories:

   a. Directory Types: Directories for new buildings or substantial renovation projects shall be as defined below. For smaller renovation projects, existing directories may be updated in kind if the signage system is not changed. Slotted boards with changeable individual letters are not acceptable.

      i. Main Building Directories: Main building directories are located at a prominent location in the entry lobby. If a university seal is not present in a building name, a colored seal may be used. Directories customarily are titled with the name of the building and/or occupant and arranged by floor listing the organizations that occupy each floor and appropriate room numbers. In multi-tenant buildings, an alphabetical listing of the occupant organizations and room numbers may be appropriate. Individual names and titles are not listed except in extraordinary circumstances as requested by the appropriate Dean or Vice President.

      ii. Floor Directories: Floor directories may be located at the building elevators or other primary entry point to floors with multiple departments or autonomous units. Organizations occupying the floor are listed to show room numbers and directional arrows may be employed if the location is not obvious to a first-time visitor. Individual names of Deans and Department heads (except “Acting”) are listed at the option of the user. Alternatively, a modified building directory, in reduced size but containing floor specific information, may be located within each elevator car, as exemplified in the Health Sciences/Human Services Library.

   b. Directory Strips: Directories shall use engraved brushed aluminum strips with a one eighth (1/8) inch reveal along the top edge adhered to a black acrylic backboard. The strips shall be changeable and mounted on a one quarter (1/4) inch thick black acrylic backboard using magnetic one (1) inch magnet tape on the back of the strip, and a full height and width magnetic sheet to the backboard. Alternatively, magnetic tape for use on a painted backboard may be used. Multiple columns with a fixed vertical line dividing the columns are used when there are many entries. Main building directories should list only major organizations in the building, but floor directories may include the name and title of departmental directors as determined by the user.

   c. Lettering Size: Lettering size on directories is typically larger than that used on interior signage and shall be large enough to be read by a visitor from the front of the security desk if mounted behind the desk, or from a suitable distance. The backboard shall be sized as required and appropriate to the design of the Lobby as indicated by the A/E on the Design Development interior elevations of the lobby. Typically, the height should not exceed twice the width.

   d. Materials, Color and Type Style: Match the building's signage system. The backboard may be framed with a narrow trim of brushed natural or black anodized aluminum as recommended by the graphic designer.

   e. Logo: The current University logo shall appear on the main building directory, exceptions for the purpose of recognizing a major institute or unit located in a

building requires approval by the University. The University and Department logo may appear on the floor directories. Consult with the University for the proper logos and electronic file of the graphic image.

f. In minor renovation projects, if modifications are limited to replacement of inserts, new material and fonts should match the remainder of the directory.

6. Room Numbers: Room numbering shall be coordinated with the University during the Design Development Phase and the approved room numbers shall appear on the 50% Construction Document set.
7. Room Identification Signs: UMB utilizes several types of room identification signs. The most frequently used room identification signs, with a sample drawing for each, are defined in the UMB Interior Signage System manual. For insert text, the text shall be centered and spacing between lines (for larger inserts) shall be 3/8".

   a. Type 'A' Room Identification Signs: These sign types are used for room identification. All signs shall have the room number in tactile letters with braille below.

      i. Type A.01 Room Number Sign with a Single Insert: Typical sign for most offices with the individual occupant's name on a replaceable insert.

         1. Size: Four and one half (4 -1/2) inches high x six 6) inches wide.
         2. Window Size: One (1) inch high.

      ii. Type A.02 Room Number Sign with a Double Insert: Used for where the name of the room requires two lines for occupant's name and title.

         1. Size: Six (6) inches high x six (6) inches wide.
         2. Window Sizes: Two (2) windows, each, one (1) inch high.

      iii. Type A.03 Room Number Sign with a Large Insert: Used for where the name of the room requires two (2) lines or more for occupant's name and title.

         1. Size: Six (6) inches high x six (6) inches wide.
         2. Window Size: Two and one half (2 -1/2) inches high.

      iv. Type A.04 Room Number and Braille Only: These signs are used for rooms that do not require additional identification, such as some research labs, storage closets, and janitor closets.

         1. Size: Two and one half (2 -1/2) inches high x six (6) inches wide.

      v. Type A.05 & A.06 Room Number Signs with a One (1) or Two (2) Line Permanent Message: These room signs are only to be used in exceptional circumstances due to the length of the message, typically used for office suites with multiple offices/rooms within.

         1. Size: Six (6) inches high x nine (9) inches wide.
         2. Top Panel: Three (3) inches high x nine (9) inches wide. Room Number text to be three quarter (3/4) inches high tactile characters in all uppercase with braille below.
         3. Bottom Panel with Message: Three (3) inches high x nine (9) inches wide, with a one eighth (1/8) inch spacer and magnetic backing. Text to be engraved in Initial Uppercase.

b. Type ‘B’ Other Room Identification Signs: These signs are installed for information and/or wayfinding such as for restrooms, wheelchair accessibility, stairs, and emergency exit.

i. Type B.01-B.04 Gender-Specific & Gender-Neutral Restroom and Locker Room Signs: Used at restrooms and locker rooms. Provide gender identification as directed by the University. All pictograms shall be tactile and include tactile lettering below with braille.

1. Size: Six (6) inches high x nine (9) inches wide.
2. Pictogram: The gender figure shall be four (4) inches high located three quarter (3/4) inch from the top and centered. If the room is accessible to the mobility impaired, then the international symbol of accessibility also shall be used. This symbol shall be one and one quarter (1-1/4) inches high.

ii. Type B.05 Stair Signs: Located at every entrance to an enclosed stair.

1. Size: Six (6) inches wide x nine (9)
2. Pictogram: The stair figure shall be four (4) inches high located three quarter (3/4) inch from the top and centered.

c. Type ‘C’ Name and/or Area Signs: These signs are used to identify a workspace in large open areas, desk or partition mounted.

i. Type C.01 Desktop Sign with a Single Insert: These signs are used for desk space in a larger open area.

1. Size: Two (2) inches high x six (6) inches wide.
2. Window Size: One (1) inch high.
3. Mounting Bracket: Mounting bracket shall be six (6) inch wide, one eighth (1/8) inch bent aluminum with a clear finish and secured in place by using double sided tape.

ii. Type C.02 Partition Sign with a Single Insert: These signs are used for cubicle space in a larger open area.

1. Size: Two (2) inches high x six (6) inches wide.
2. Window Size: One (1) inch high.
3. Mounting Bracket: Mounting bracket shall be four (4) inch wide, three sixteenth (3/16) inch bent clear acrylic, depth to suit partition thickness and secured in place by using double sided tape.

d. Type ‘D’ Directional Signs: These signs are used for wayfinding within a building, sign size and general design to follow the building standard. Lettering to be engraved with arrows for direction.

i. Type D.01-D.03 Directional Signs: Generally, signs of size six (6) inch x six (6) inch, six (6) inch x nine (9) inch and six (6) inch x twelve (12) inch are used. Refer to the published UMB CAD details for signage.

8. Information Signs with Changeable Message (Type ‘E’ Signs):

a. Information Signs: These signs are installed for special purposes including changeable information and are sized to hold an eight and one half (8 -1/2) inch x eleven (11) inch sheet of paper in a window insert.

i. Type E.01 Emergency Information Signs: These signs are located throughout the building by the University Fire Marshall as directed by the University. Generally, the sign heading is "EVACUATION" or "AREA OF RESCUE ASSISTANCE." The signs are sized to hold an eight and one half (8 -1/2) inch x eleven (11) inch sheet of paper (in the horizontal position) in a window insert.

1. Size: Fourteen (14) inches high x nine and one half (9 - 1/2) inches wide.
2. Window size: Eight and one quarter (8 - 1/4) inches wide x ten and three quarter (10 - 3/4) inches high.
3. Sign Heading Text: One (1) inch high engraved Futura Book.

ii. Type E.02 Announcement Sign: These signs are used for conference room announcements, room scheduling or a temporary directory for a space under renovation. Generally, the sign heading is "ANNOUNCEMENTS" or "CONFERENCE." If this type of sign is used as a personnel directory to augment a floor directory, the subsurface heading "PERSONNEL" is used. Bold typescript the same as or approximating Futura Book on white or colored paper is used as the changeable insert and is supplied by the building occupant.

1. Size: Fourteen (14) inches high x nine and one half (9 -1/2) inches wide.
2. Window size: Eight and one quarter (8 -1/4) inches wide x ten and three quarter (10 - 3/4) inches high.
3. Sign Heading Text: One (1) inch high engraved Futura Book.

9. Special Information Signs with Permanent Message:

a. Fire Egress Signs: These signs shall be located in elevator lobbies and in each elevator cab. The design of the sign shall include an engraved symbol in the surface overlay with engraved text below.

i. Size: Seven and three eighths (7 - 3/8) inches high x six (6) inches wide.

10. Other Interior Signs: Operational and other technical information, such as equipment labels, piping and valves, warnings, etc. shall be provided outside the signage system by the relevant technical trades as defined by UMB. If such information is exposed to public view, its location, type size and color shall be coordinated with the UMB Interior Signage System or otherwise to match the building signage. As examples, "The FIRE COMMAND CENTER" sign located prominently in the Lobby of high rise buildings may use red lettering on a brushed aluminum background.

a. All signs shall match the background and text colors, lettering style and size, and materials of the University Building Signage System unless otherwise noted.
b. Signs such as "No Smoking," "show badge" and other notices are discouraged as these signs add to visual clutter and usually address information that becomes dated or is known to the occupants of the building. Information of a temporary nature should not be confused with permanent building signage.

c. Permanent signs that require differentiation from the University Building Signage System, such as those describing a displayed artifact or to mark a significant historical event, shall be of brushed aluminum or stainless steel panel of a size appropriate for the text and location, and may have a simple, narrow black frame. Most often such plaques are twelve (12) inch x twelve (12) inch, with square corners and concealed mounting. Text shall be inscribed with Futura Book style.
d. Enclosed lockable bulletin boards for policy statements and legally mandated notices, where required, should be placed near the main building entrance as recommended by the A/E and approved by UMB. The frame and trim and interior tackboards or "slatwall" shall be brushed aluminum color, or as recommended by the A/E to match other work.
e. Code mandated EXIT signs are described in Chapter 24 – Power and Lighting Systems Design
f. The University Department of Environmental Health and Safety (EHS) inspects new facilities, installs, and maintains a uniform system of hazardous materials warning signs which are customarily located on the door(s) of laboratories and storage areas.

G. Interior Signage (Pre-2004 UMB Sign Standard)

1. Pre-2004 Signage Design Standard

a. Background: The design of interior signage has evolved significantly over several decades at UMB. In the early 1990's changes were made in the institutional logo and in the field colors and later in the text color of the interior signage. Over a dozen background colors particular to different major buildings and/or schools had been used across the campus, but always in the same size and shape of sign and text content.
b. Pre-2004 Signage Design Standard: The specification for construction and the various color designations and formulae of the previous sign design(s), for use when providing signage that is to match existing conditions at a building, is specified in the UMB Master Specification, Section 101400- Interior Signage, Since the use of this old sign standard is very limited, and is to match existing adjacent signage, it is not described herein in detail.

2. Interior Graphic Images: Refer to the UMB published Technical Specifications and Signage CAD Details for signage requirements for renovation projects at buildings which have the pre-2004 Sign Standard as the building standard.

H. Monumental Inscriptions- Exterior

1. Incised Lettering in Stone: A standard for incised lettering in stone was developed for use at the Health Sciences and Human Services Library (HSHSL). The standard is not considered to be compulsory if the project A/E should justify another design approved by the University. Variation in typeface within the broader standard context of the Indiana Limestone field and relevant point size might be considered an enrichment of a design as recommended by the project A/E approved by the University. If it is determined that new work should match the existing, the specification for the inscription is summarized as follows:

a. Font Style: Palantino, normal.

b. Engraving: Incised V-groove.

2. Corner Stones: Cornerstones customarily have not been installed on University buildings. Proposed installations shall be submitted to the University for review and approval.

I. Sign Layout And Design

1. Commonly Used Signs: CAD and PDF files of Signage Details are available by request.

16.2 Toilet Rooms And Accessories

A. Toilet Rooms: All toilet rooms shall be handicapped accessible in accordance with ANSI A-117 and the "Americans with Disabilities Act (ADA)". All toilet rooms shall include the required number of plumbing fixtures as per the Building and State Plumbing Codes.

1. Toilet Room Wall Finishes: Unless otherwise approved by UMB all wall surfaces at sink locations and at water closet and urinal locations shall have a ceramic tile finish, with white grout to a height of twelve (12) inches above the highest flush valve. Wall surfaces above the ceramic tile shall be painted in accordance with the requirements of these Design Standards.
2. Toilet Room Ceilings: All toilet room ceilings shall be acoustical suspended ceilings to permit access to mechanical and electrical components.

16.3 102113 Toilet Compartments

A. Solid, high-density polyethylene (HDPE) panel, seamless, with eased edges, no-sightline system.
B. Integral hinges.
C. Finish: Homogenous color and pattern through thickness of material, graffiti-resistant.
D. Compartment Style: Over-head braced, floor anchored.
E. Partition Height: Overall 6’-11” (9” clear minimum open bottom / 62” solid privacy panels.
F. Pilaster Shoes and Sleeves (Caps): Stainless steel.
G. Urinal-Screen Post: 1-3/4-inch- square aluminum tube with satin finish, shoe and sleeve cap matching that on the pilaster.
H. Latch and Keeper: heavy-duty stainless steel, with provision from emergency access.
I. Door sizes: minimum 24-inch-wide inswinging, and 36-inch-wide outswinging at accessible compartments.

16.4 102800 Toilet/Shower Room Accessories:

A. The following toilet room accessories are to be specified unless specifically required otherwise by the project program:

1. Paper Towel (Roll) Dispenser for Public Restrooms

a. Kimberly Clark: Sanitouch #09990, ABS plastic, Smoke

2. Paper Towel (Roll) Dispenser for Kitchenettes and Laboratory Sink Areas

a. Kimberly Clark: Sanitouch #09746, ABS plastic, Smoke Gray.

3. Toilet Tissue Dispenser:

a. Kimberly Clark; Cored JRT Jumbo Combo Tissue Dispenser; Color #09551 Smoke/ Grey finish

4. Soap Dispenser:
   a. EcoLab #92023091 NEXA Manual Compact Dispenser in Black
   b. EcoLab #92021193 NEXA Touch-Free Compact Dispenser in Black
5. Grab Bar
   a. 1-1/2" diameter Stainless Steel 0.05 inch thick with concealed fastener flange mounts.
6. Seat-Cover Dispenser
   a. Bobrick model B-221
7. Shelf:
   a. Stainless steel concealed mounting, 5 inch depth
8. Mirror Unit
   a. Size indicated on Drawings, stainless steel angle from 0.05 inch thick mitered and mechanically locked corners.
9. Diaper-Changing Station
   a. Product: Koala Kare model #KB310-SSRE.
10. Trash Containers:
    a. Specify free standing grey molded plastic trash cans with a 23 gallon capacity, approximate size 20 inches long x 11 inches wide x 30 inches high, Rubbermaid Slim Jim Container, Model #3540.
    b. Wall mounted semi-recessed type trash containers are not acceptable to UMB and therefore shall not be considered for campus projects.
11. Hand Dryer: Must be approved by UMB for use in public rest rooms.

16.5 102800 Shower Room Accessories:

A. The following shower room accessories are to be specified unless specifically required otherwise by the project program:
   1. Shower Rod and Hooks: Shower rod and hooks shall be 18 gage, one and one quarter (1-1/4) inch diameter, stainless steel tubing with two and one half (2-1/2) inch square mounting squares.
   2. Shower Curtain: Size shall be 42 inch by 72 inch, opaque, matte white vinyl, .008" thick, contains antibacterial and flame retardant agents, nickel-plated brass grommets along top, one every six inches, hemmed bottom and sides, equal to Bobrick "Shower Curtain, Item Number 204-2 and Hooks, Item Number 204-1."
   3. Towel/Robe Hook: Heavy gage stainless steel with a concealed wall plate, with no exposed fasteners.

16.6 102600 Wall and Door Protection - Corner Guards and Kick Plates:

A. Corner Guards: In high traffic and/or utility areas which require high durability, corners and “wing walls” shall be protected by a two and one half (2-1/2) inch x two and one half (2-1/2) inch or four (4) inch x four (4) inch brushed stainless steel corner guards, glue applied, no exposed screws.
B. Kick Plates: Kick plates shall be provided on doors and other locations subject to damage from regular use. Customarily, kick plates are to ten (ten) inches high for the full width of the door or match adjacent kick plates. Armor plate shall be used on the push side of doors in Animal Facilities and at door subject to high abuse by rolling cart traffic.

End of Chapter

Chapter 17: Furnishings

Updated November 20, 2024

17.1 Furniture Provider Policy

A. Current University policy requires the use of furnishings manufactured or assembled by Maryland Correctional Enterprises (MCE) if the furnishings are available. Exceptions must be approved by the UMB Office of Office of Strategic Sourcing and Acquisition Services. MCE provides office workstations and furniture, including filing and seating. They do not provide laboratory casework, chalk or marker boards, or other operating equipment.

17.2 Window Treatments:

A. General: All exterior windows are to have window treatments and are to be commercial grade for heavy-duty use. The selection of interior and exterior window treatment shall consider appearance, durability, and level of light control required. Both horizontal blinds and woven mesh shades are established standards at UMB, as follows:

1. 122113 Horizontal Blinds: Manual-operated Venetian blind.
2. 122413 Roller Window Shades - Woven Mesh Shades: Both single and dual shade systems are acceptable, depending on specific project requirements.
3. Motor-operated Systems: Motor-operated systems shall be used where bead chain length is excessive or not accessible, or blackout shades are required to interface with A/V equipment.
4. Other Window Treatments: Drapes and other type window treatments are not usual on the campus, but may be considered, as reviewed by UMB.
5. Renovation Projects: When installing window treatments in an existing building, match building standard for a cohesive exterior appearance, unless otherwise approved by UMB.

B. 122113 Horizontal Blinds: Manually operated Venetian blind conforming to ANSI/WCMA Standard A 100.1 for safety of corded window covering, and ASTM E84-89 for all materials.

1. Approved Manufacturers:

    a. Graber,
    b. Levelor,
    c. Hunter Douglas,
    d. Bali.

2. Slats: Slats to be minimum .008 inch thick spring-tempered aluminum with crowned profile and radiused corners. Slat height shall be one (1) inch.
3. Slat Support: Slat support shall be woven polypropylene, ladder configuration. Lift cord shall be braided polyester/rayon, continuous loop.
4. Blind Height: Blind height shall not exceed twelve (12) feet and widths shall not exceed seventy two (72) inches. Division between blinds shall occur only at mullions of continuous windows or openings where more than one blind for one opening occurs.
5. Color: Color shall be selected from manufacturer’s standards, and shall be factory-applied, light-colored.

6. Headrail Housing: Formed steel “U” channel internally fitted with hardware, pulleys, and bearings for blind operation cross braced for rigidity. Valances are not permitted unless an integral part of headrail housing.
7. Bottom Rail: Formed-steel box to match slat and reinforced to prevent twisting or sagging. End caps shall be metal.
8. Wand: Control wand shall be transparent plastic.
9. Cords: Control wand and lift cord shall be in length sufficient for easy operation from a convenient position location shall be specified on a drawing or on a submittal for review.
10. Installation: Install level and plumb in accordance with the manufacturer’s written instructions. The installer shall ensure unencumbered operation of window sash hardware.

C. 122413 Roller Window Shades - Woven Mesh Shades: Type of shade fabric and method of operation shall be selected to meet specific project requirements. Dual shade systems, with both shades located in the same pocket shall be used where both blackout and light filtering fabrics are required at the same location.

1. Approved Manufacturers:

   a. MechoShade Systems, Inc.
   b. Vimco.

2. Shade Cloth: Shade cloths shall have no seams and hang flat without buckling or distortion. Edge, when trimmed, shall hang straight without raveling.
3. Shade Fabrics: Shade fabrics shall be certified by and independent testing laboratory to pass NFPA 701 and applicable code requirements. The roller shade shall be opaque and density shall suit project conditions, options include 3% open, 5% open, 8% open, 13% open, and15% open.
4. Area Coverage: Each shade shall fully cover the opening where it occurs. Breaks between the units occur only at mullions or other defined vertical separations for continuous installation.
5. Valances: Valances shall be snap-on aluminum fascia or covered to match the shade cloth. Side and sill closure channels shall be provided between shade sides and window jambs and between hem bars and sills finished to match valance.
6. Guide Rails: Guide rails for motorized shades shall not be used at locations with operable windows.
7. Roller Shade Cloth: Unguided roller shade cloth shall hang true and straight, without shifting sideways more than one eighth (1/8) inch in either direction due to warp distortion or weave design.
8. Chain: Chain at manual shades shall be number ten (10) stainless steel bead chain formed in a continuous loop. Chain operator shall be in length sufficient for easy operation. Plastic hem grips are not used.
9. Support Hardware: Shade support hardware shall be capable of supporting 150% of the full weight of each shade. Shall be adjustable for exterior of shade unit without disassembly of hardware and shall have a built-in shock absorber system to prevent chain breakage under normal usage.
10. Power Operators: Control systems and components shall be approved as a system by either Underwriter Laboratories (UL) or Electrical Testing Laboratories (ETL).

11. Motor Control System: To be coordinated for specific project requirements and for interface with low voltage audio-visual systems.

D. Specification Requirements: The architect shall includethe following information in the project specifications:

1. Special Warranty Performance Requirements: Specify that the contractor shall provide a warranty that includes the following special warranties:

   a. Tracks, gear-and-sprocket mechanism, and accessories for shades shall be warranted for five (5) years against defects in materials and workmanship which inhibit proper and intended functioning of products.
   b. Shade cloth shall not deteriorate, sag, or warp and will remain fit for use for no less than ten (10) years.

2. Installation: The installer shall verify all field dimensions: install shades level and plumb and ensure unencumbered operation of window sash hardware. Metal parts of shade units shall be isolated from concrete mortar to prevent galvanic action.
3. Shop Drawings: Specify that the manufacturers shop drawings shall include the following:

   a. Shade assembly mounting details, including wiring diagrams for motorized systems.
   b. Position of shade or blinds in relationship to glass or frame surface.
   c. Special conditions at external and internal corners.

17.3 Wood Laboratory Casework

A. General: Casework includes base cabinets, countertops, wall cabinets, wall shelving, reagent shelving, drawers, knee spaces, built in utility chases etc.
B. Hardware: Specify, cabinet hardware shall be furnished and installed by the cabinet fabricator so that a single responsibility is achieved. Pivot hinges, however, should be supplied and installed in the in the field because of their tendency to shift during setting and fitting of cabinets. The following guidelines shall be included in the contract documents:

1. Indicate all key-locked units.
2. All hardware shall be ADA compliant.
3. Exposed hardware shall be finished as either brushed stainless steel or brushed chromium plate.
4. Finish hardware for cabinets shall be installed at factory.

C. Guidelines:

1. Tops, Back and End Splashes on Wet Benches: One (1) inch thick black epoxy, or “Kemresinlite”. Splashes to be bonded to top surfaces. Provide splashes at all vertical surfaces, dedicated work stations, and fume hoods. All edges to have grooved drips. Alternative, as directed, may be one (1) inch self-edged. acid resistant laboratory grade high pressure plastic laminate (HPDL) with .020 (mil/inch) BKL/HPDL backer sheet. Seal backsplashes to wall.
2. Tops on Thirty (30) Inch High Work Stations: One (1) inch self- edged 0.039mil/in HGL/HPDL/n plywood core with .020 BKL/HPDL backer sheet on all other exposed surfaces.

3. Cabinet Bodies: three quarter (3/4) inch thick veneer plywood with plain-sawn oak veneer except where noted (AWI premium grade) and one half (1/2) inch thick solid red oak banding. Floor mounted fully enclosed with toe space.
4. Drawers Sides, Back and Front: three quarter (3/4) inch thick veneer core plywood with oak veneer or three quarter (3/4) inch thick solid oak wood.
5. Drawer Bottoms: Minimum three eighths (3/8) inch plywood or similar material.
6. Doors: three quarter (3/4) inch thick, plain sliced red oak veneer plywood and one half (1/2) inch thick solid red oak banding.
7. Shelving: Shelving, exposed and in cabinets; three quarter (3/4) inch thick x twelve (12) inch deep plain sliced red oak veneer core plywood banded on exposed edges with a one half (1/2) inch thick solid red oak banding.
8. Reagent Shelving: One (1) inch thick plywood core, acid resistant laboratory grade PHDL self-edged all surfaces, to support minimum 50 psf. Screw mount shelves to double-track stainless steel adjustable brackets rated for two hundred (200) lb. load (including heavy duty clips). Top shelf shall be fixed no higher than seven (7) foot – four (4) inches above floor, and no closer to ceiling than eighteen (18) inches. At reagent shelving, above lab benches, the one half (1/2) inch thick solid red oak band to be one inch high, to provide a one quarter (1/4) inch high lip at the outside edge of the shelf. Omission of this lip shall be at the discretion of the Office of Facilities Management after consultation with the User.
9. Pulls or Handles: Round pulls, five (5) inches long x two and one half (2-1/2) inches deep x five sixteenth (5/16) inches in diameter and shall be ADA compliant. Knobs shall not be acceptable.
10. Wood Grain: Grain in adjacent panels shall be matched as to direction, color, and density. Wood grain shall be an all vertical pattern.
11. Drawer Slides: Drawer slides for drawers with a depth of seven (7) inches or less shall be at minimum medium weight, full extension. Slides for drawers with a depth greater than seven (7) inches shall be heavy duty, full extension hinges, and hardware on millwork shall be commercial grade.
12. Pegboards: Twenty four (24) inch x thirty (30) inch x one (1) inch thick “Resistop” laboratory pegboards with thirty nine (39) polypropylene pegs each, and stainless steel drip trough and drain tube to align with sink.
13. Peninsula Benches: Peninsula benches shall have adjustable reagent shelving, as above, with oak or HPDL finished casework pilaster chases for mechanical/electrical services from bench top to minimum of six (6) inches above ceiling and anchored to structural deck.

D. Millwork: Millwork shall be fabricated and installed so that in future renovations it can be disassembled in complete units and reinstalled.
E. Millwork Joints: Millwork material shall be installed with minimal joints or concealed nails and fasteners. Joint location and design, edge banding, and wood blocking, shall be installed to allow for natural wood movement and building movement.
F. Plywood: Plywood used for mounting of telephone and electrical equipment shall be three quarter (3/4) inch thick fire retardant plywood panels; that shall be secured sufficiently to the wall to support apparatus.
G. Plastic Laminate Seams: Plastic laminate seams shall be a minimum of thirty six (36) inches from a sink edge.

H. The A/E shall employ its successful experience in institutional design and construction to address the requirements of each specific project, as reviewed and approved by the University.

End of Chapter

Chapter 18: Conveying Equipment

Modified November 21, 2024

18.1 UMB Overview

A. The University operates and maintains approximately one hundred (100) elevators and lifts of almost every conceivable type, configuration, and age. A trained staff capable of troubleshooting and repair of the equipment is employed. The size and complexity of this component of the physical plant necessitates cost-effective procedures which range from stocking parts and training to requiring that each new or replacement conveyance meets the standards outlined in, or reasonably inferred from, the requirements of this part.
B. Review of design and construction is undertaken by University personnel as local building permits are not obtained for projects under State jurisdiction. The A/E, builder and equipment manufacturer shall be responsible for a design and installation which will comply with state elevator certification standards and testing requirements.

18.2 Codes And Standards

A. Code of Maryland Regulations (COMAR): This code includes provisions that require elevators serving three or more floors to have a minimum clear interior car dimensions large enough to accommodate a stretcher six (6) feet – eight (8) inches long by two (2) feet – zero (0) inches wide (minimum six (6) feet – eight (8) inches wide x five (5) feet – five (5) inches inside cab) and a three thousand five hundred (3,500) lb. capacity. See other requirements in this part for projects with a single elevator.
B. Standards: Elevator standard ASME/ANSI A17.1, latest edition adopted by the State Department of Licensing and Regulation, Division of Labor, “Regulations Governing Elevators, Dumbwaiters and Moving Walks” (including supplement A17.1a "Safety Code for Elevators and Escalators “).
C. Current ADA Accessibility Guidelines.

18.3 Elevator Traffic Analysis Study:

A. As part of the Basic A/E Design Service, at the Schematic Design Phase, furnish a complete analysis of elevator demand and compliance for the project. The analysis shall be updated at each succeeding design phase submittal. If the complexity of the project warrants, a qualified elevator consultant shall be employed to conduct the analysis.
B. The analysis shall be based on the interval of a five (5) minute handling capacity, projected population for the building type, the total area to be served, including impact of adjoining buildings, if any, and any other special requirements of the building program. Except as otherwise directed by the University, service elevators shall not be included in the calculation of pedestrian traffic and exiting.
C. The analysis shall provide hoistway dimensions to accommodate a minimum of three (3) manufacturer’s standard products that are sized to meet the capacity requirements of the traffic analysis.

18.4 Elevator Hoistway

A. The elevator hoistway shall be encased through its full height in a fire-resistant enclosure per the building code.

B. Floor numbers shall not be less than four (4) inches in height and shall be located on the hoistway side of doors and panels.
C. The elevator hoistway shall be provided with means to prevent the accumulation of smoke and hot gasses in case of fire, as required by the building code.
D. If there is a dimensional change in the hoistway that creates a ledge greater than one half (1/2) inch, it shall be beveled at an angle of not less than sixty (60) degrees or more than seventy-five (75) degrees.
E. Elevator rails shall not be used as the lightning protection system grounding conductor.
F. The hoistway shall be designed to accommodate the cab dimensions of at least three (3) different manufacturers.

18.5 Elevator Pit

A. Drains connected directly to sewers shall not be installed in the elevator pit. A sump basin with a sump pump shall be designed in the base of the elevator pit to collect the accumulation of water in the elevator pit. The elevator pit sump basin shall be covered and level with the elevator pit floor. Coordinate with the electrical engineer to provide emergency power for the sump pump. Also provide an oil separator, located remote from the elevator pit, for sump pump discharge where required by code. Provide a high-water level alarm, connected to the building automation system.
B. A fixed vertical ladder shall extend not less than forty-two (42) inches above the sill of the elevator pit access door.
C. Permanent energy efficient electrical lighting shall be provided in the elevator pit with a minimum illumination of ten (10) foot candles at the pit floor. Lighting shall be fluorescent vapor proof type with a wire guard. The light switch shall be accessible from the access door. A duplex GFCI electric receptacle rated not less than 15 amps, 120 volts shall be provided in the elevator pit on dedicated circuit, designed in accordance with the NEC 620, latest edition.
D. An elevator stop switch shall be installed in the elevator pit. The stop switch shall be accessible from the elevator pit access door. When access to the pit is through the lowest landing hoistway door, a stop switch shall be located approximately eighteen (18) inches above the lowest landing floor. When the pit exceeds sixty-seven (67) inches in depth, an additional stop switch is required. Where more than one switch is provided, they shall be wired in series.
E. Where the depth of the elevator pit exceeds sixty-seven (67) inches, a working platform of galvanized steel shall be included in the design in compliance with code requirements.
F. The design of hoistway pits shall be of sufficient dimension and depth to accommodate the standard products of a minimum of three acceptable elevator manufacturers that comply with the traffic analysis.

18.6 Elevator Equipment Requirements

A. General: It is the University's preference to utilize a holeless hydraulic elevator system for buildings of three floors or less. For buildings of more than three floors, the University prefers the use of electric traction elevators. The design of holed hydraulic elevators requires written approval by UMB.

B. Elevator Type Approval: Architect shall review the type of elevator with the owner to determine the suitability of the elevator type with the building type and occupancy. The type of elevator shall be determined during planning phase in consultation with UMB Project Manager, Operations and Maintenance representative, and the Elevator Shop Manager

C. Electric Traction Elevators: The design shall utilize standard commercial quality, pre-engineered electric traction equipment, including cars, hoistway entrances, control and signal systems, safety equipment, hoistway equipment, and elevator machinery. Include the following in the construction documents:

1. Specify 'T' - type guide rails; tubular guides will not be permitted.
2. Specify roller guide shoes.
3. Specify the elevator to operate at a minimum of three hundred fifty (350) feet per minute.

D. Hydraulic Elevators: The design shall utilize standard commercial quality, pre-engineered hydraulic equipment, including either direct or indirect systems of a hydraulic plunger and cylinder (jack), with other components of the work including fluid storage tank, submersible hydraulic power unit, pump, piping, valves, car enclosures, hoistway entrances, control systems, signal equipment, guide rails, electrical wiring, buffers, and devices for operating, dispatching, safety, security, leveling, alarm, maintenance, and similar required performances and capabilities. Include the following in the construction documents:

1. Indicate intended support and anchorage system for above-grade jack units, guide rails, and sills, noting what part of the work is "elevator work".
2. Indicate well or casing locations, depths for hydraulic jacks and the plunger/cylinder. The cylinder shall have auxiliary PVC casing for protection against electrolysis, and proper sealing against water intrusion.
3. Hydraulic piping and electrical conduit shall be run overhead.
4. Specify the elevator to operate at a minimum speed of two hundred (200) feet per minute.

E. Service Elevators: In all projects at least one elevator, and in single elevator installations, one elevator, shall service all levels, including basement, penthouse mechanical levels, and the roof level if large mechanical equipment is located on the roof. This elevator may be designated as "service" in multi-elevator installations and may be located remote from a multi-elevator passenger bank. A service elevator is not required for parking garage designs. Include the following in the construction documents:

1. Capacity shall be five thousand (5,000) lb. with an oversized cab to accommodate occasional moving of furniture, equipment, or materials.
2. Car platform minimum clear inside dimension shall be six (6) feet – eight (8) inches wide x nine (9) feet – four (4) inches deep x nine (9) feet – four (4) inches clear high. Hoistway doors shall be five (5) feet – zero (0) inches clear x seven (7) feet – eight (8) inches high, two (2) speed side opening.
3. Specify the elevator to operate at a minimum speed of three hundred fifty (350) feet per minute.
4. Specify operation as Simplex selective, collective.

5. Elevator controls shall be a microprocessor-based system to properly service the building use. The controls shall be specified to provide relay outputs for remote monitoring of alarms and trouble signals.
6. Elevators shall be connected to the building emergency power system.
7. Hoistway entrance doors and frames shall be of fire-resistant labeled construction as required by the Code. University standard finish is stainless steel complying with AISI type 302/304 with manufacturer's standard vertical natural satin finish. Doors shall be hollow metal one and one quarter (1.25) inch thick of seamless welded flush construction, fabricated of 16-gauge sheet with internal reinforcing channels spaced six (6) inches on center and spot welded four (4) inches on center to face sheets. Provide keyhole at every floor level.

F. Prohibited Elevator Types: Machine-Room-Less (MRL) Elevator, roped hydraulic, telescoping, or inverted lunger assemblies are not permitted.

18.7 Elevator Cab

A. Cab enclosures shall be developed to indicate floor selection buttons incorporated in a brushed stainless-steel panel (No.4 finish) designed to accommodate all required signage, fireman's key, key box, and any other signal equipment. Exit floor indications, braille and graphic signage shall be in strict accordance with requirements of the code. Provide the following:

1. The A/E shall select appropriate, durable finishes and lighting for the intended use of the elevators. Submit selected finishes and lighting to the University for review and approval at the Design Development Submission.
2. Specify that removable fire rated protective pads for all cab walls, including mounting hardware, shall be included with the elevator cab.
3. Specify that code required signage for fire service operation shall be engraved on both hall call stations and car operating panels.

B. Dedicated service elevator cab enclosures shall include the following:

1. Front transom, wall panels, doors and door frame shall be 16-gauge AISI, type 302/304 stainless steel with manufacturer's standard directional polish or satin finish.
2. Steel sheets for exposed metal panels, walls and ceilings shall be stretcher-leveled, cold rolled commercial quality furniture steel, complying with ASTM A 366 matte finish.
3. Exterior of cab shall receive a sound deadening material. Reveals, base and frieze shall be stainless steel with # 4 finish.
4. Sills of cab and hatchway shall be cast iron complying with ASTM B48, class 20 gray iron casting not less than seven sixteenth (7/16) inch thick with an antislip surface.
5. Flooring shall be suitable for extra heavy traffic service such as "Nora Rubber Flooring," "Norament 925A" or other durable material with surface complying with ADA requirements. Specify a ten (10) year warranty.
6. Lighting shall be energy efficient, and sufficient to provide ten (10) foot-candles at rail height. Conceal source, but provide easy access from within the cab for replacement of lamps and ballasts, etc.
7. Provide handrails and low bumper rails on sides and back consistent with requirements of the code.

8. Provide a removable protective blanket lining for sides and rear of the car complete with hooks and blanket grommets.

18.8 Elevator Machine Room

A. Access to the machine room and overhead machinery space shall be provided by a stairway with a platform and swinging door at the top level. The size of the platform shall be sufficient to permit the full swing of the door plus two (2) feet from the top stair riser to the swing line of the door.
B. The access door to the machine room and overhead machinery space shall be a minimum thirty-six (36) inches wide and six (6) feet eight (8) inches high and shall be self-closing and self-locking. Doors must be kept closed and locked and shall have a spring-type lock arranged to permit the door to be opened from the inside without a key.
C. Specify that a stop switch shall be located adjacent to each elevator controller.
D. Headroom in the machine room and overhead machinery space shall be a minimum of seven (7) feet.
E. Permanent energy efficient electrical lighting shall be provided in the machine room with a minimum illumination of nineteen (19) foot candles at floor level. The light control switch shall be mounted on the wall adjacent to the lock jamb side of the access door. All elevator machine rooms shall have emergency and normal lighting.
F. The machine room shall be cooled, heated, and ventilated to provide the correct conditions for efficient control, machinery, and personnel operation. Coordinate the type of cooling and heating system and control requirements with UMB. The machine room shall not vent into the hoistway or stairwell. The temperature and humidity shall be continuously monitored through the building automation system.
G. Provide dedicated power circuits for each elevator controller in each machine room. A GFCI duplex receptacle rated at not less than 15 amps, 120V shall be provided in each machine room.
H. The only ducts, piping, conduit, and wiring permitted to be installed in the hoistway, machine room, and machinery space are those required for heating, cooling, and ventilating these specific spaces.
I. Standard sprinkler protection conforming to the requirements of ANSI/NFPA 13 shall be installed in the hoistway, machine room and machinery space. All risers and returns shall be located outside these spaces. Branch lines in the hoistway shall supply sprinklers at not more than one (1) floor level. Smoke detectors shall not be used to activate sprinklers in these spaces or to disconnect the main line power supply. Pipes or ducts conveying gasses, vapors, or liquid not associated with the operation of the elevator shall not be installed in any hoistway, machine room, or machinery space. Hydronic and sprinkler piping serving roof top elevator machine rooms shall be located in conditioned shafts to prevent freezing.
J. Air conditioning equipment is permitted in the machine room. Air conditioning equipment shall not be located directly above elevator equipment. The clear head room below suspended air conditioning equipment shall be seven (7) feet minimum. Air conditioning condensate drains shall not be located directly above elevator equipment.

18.9 Specification Requirements

A. Specifications for the elevator contract shall specifically state the requirements of these Design Standards. It is not sufficient to cite blanket requirements for warranties, post-construction maintenance, etc.

B. Include the following requirements in the project specifications:

   1. Product Data:

      a. Signal and operating fixtures, operating panels, and indicators.
      b. Cab design, dimensions, layout, and components.
      c. Cab and hoistway door and frame details.
      d. Electrical characteristics and connection requirements.

C. Acceptable Manufacturers:

   1. Basis of Design: Virginia Controls
   2. Motion Control Engineering (MCE)

D. Diagnostic and Test Equipment: Specify to provide as an integral component of the elevator contract, and at no additional cost, any and all forms of proprietary testing and diagnostic equipment required to gain access to the control system, to identify malfunctions, to make adjustments to the equipment systems, or to conduct service, maintenance, and periodic safety tests. This shall include a laptop computer or other complete analyzer hardware/software used to diagnose or maintain all programs in system equipment for trouble shooting and proper maintenance.

E. Instruction Manual: Specify to provide an instruction manual on the use of the diagnostic tool that includes all the fault codes identification, detailed description, and correction procedures. Also specify to provide hardware and software updates during the warranty period and for an additional seven (7) years after the warranty period has expired.

F. Replacement Circuit Boards: Specify that the manufacturer shall provide at no additional cost to the owner one complete set of replacement printed circuit boards for all units of the control system and motor drive. There should be one replacement board for each board type. If separate boards for the drive are not available, provide one replacement drive for each drive model.

G. Demonstration: Specify that at the time of equipment acceptance, the manufacturer shall provide eight (8) hours of on-site instruction to University elevator service personnel in the proper use, operation, and on-going maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed for failure of equipment operation, as well as other common building emergencies. Train the University personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions. Confer with UMB on requirements for a complete elevator maintenance program. All submittals and maintenance documents must be turned over to maintenance personnel before the instruction is scheduled to allow time for review and familiarization. Include instruction on special or proprietary equipment, computer hardware, software, and other devices utilized for diagnostic trouble shooting and malfunction identification.

H. Service:

   1. The Contractor shall be responsible for all state-required annual CAT1 elevator testing, covering all associated costs.

      a. Owner (UMB) will manage the scheduling and payment for third-party inspection services required during the annual elevator testing.
      b. The Owner (UMB) will be responsible for the state-required annual elevator fire recall and emergency power testing.

2. Initial Maintenance Service: Specify that the purchase and installation contract shall include full maintenance service by skilled, competent employees of the elevator installer, working under supervision of the elevator manufacturer or manufacturer's authorized representative(s), for a period of twenty-four (24) months following the date of Final Acceptance or Substantial Completion.
3. Continuing Maintenance Service: Specify that the installer shall provide, with the initial bid documents, a continuing full-service maintenance proposal to the University, in the form of a standard yearly maintenance agreement commencing on the date construction contract warranty and initial maintenance requirements are concluded. State the services, pricing, structure, obligations, conditions, and terms for the agreement period, and for future renewal options for up to five (5) years.
4. All proprietary equipment furnished and installed with the elevator(s) shall become the property of the University, and any replacement parts shall be available to the University and/or any third-party vendor which may provide equipment maintenance under contract to the University solely for University use.

I. Special Project Warranty: Specify to provide a special project warranty, signed by the general contractor or construction manager, Installer, and manufacturer, guaranteeing the replacement, repair or restoration of defective materials and workmanship in the elevator work, and including any related repair or replacement work during the stated warranty period.

J. Project Records: The contract shall require that at the time of acceptance of the equipment, the following shall be provided to UMB in five (5) copies:

1. Complete sequence of operations for all elevators.
2. Complete control equipment layout and assembly drawings for parts pertaining to electrical, mechanical, electronic, and solid-state equipment including printed circuit boards component layout for all boards used throughout installation.
3. “Record Drawing” wiring diagrams indicating the complete installation as constructed.
4. Motor and machine data, electrical, and mechanical data, pertaining to elevators.
5. Equipment layouts and assembly prints, drawings (record prints) pertaining to car, hatch, machine room, pit, and shaft.
6. Service, adjustors, work processes or product manuals for all units of the elevator system with all update bulletins.
7. Include material lists and parts manuals for all elevator equipment, including printed circuit boards and identify each entry with equipment description and order number.
8. Maintenance and service contract and warranty.

End of Chapter

Chapter 19: Mechanical Design General Requirements

Amended 09-19-2022, See underlined text

19.1 Scope:

A. This division outlines the general objectives and criteria for designing mechanical systems. It deals with general office, research, and institutional buildings; however, principles herein shall be followed, where applicable, for special-purpose buildings. Many of the existing systems serving the UMB buildings may not comply with these current standards due to their age. However, it is the intent that all design of both new and renovated systems be done in accordance with these Design Standards. Instances where existing conditions preclude compliance with the standards should be brought to the attention of UMB for discussion and resolution.

B. **Mechanical Systems:** For these Mechanical Design Standards, the reference to 'Mechanical Systems" includes the following:

1. **Plumbing Systems;** Includes Sanitary and Vent, Acid Waste and Vent, Storm Water, Cold Water, Hot Water, Hot Water Recirculating, RO/DI, Laboratory Gas, piping systems and all associated equipment.
2. **HVAC Systems:** Includes Chilled Water, Condenser Water, Glycol (energy recovery), Steam and Steam Condensate (10 PSIG and 60 psig) piping systems and associated equipment and controls.
3. **Fire Protection Systems:** Includes Wet, Dry, and Pre-Action Piping Systems and associated equipment.
4. **Associated Equipment:** Includes pumps, hot water generating/storage equipment, heat generating equipment heat rejection equipment.

19.2 Design Submissions:

A. The A/E shall submit design documents, proposals, drawings, sketches, calculations, specifications, etc. at various stages in the design process. For mechanical requirements of each submission, refer to this division and the UMB Procedure Manual for Professional Architectural and Engineering Services for UMB Construction and UMB UM Service Centers, latest edition.

19.3 Codes, Standards And Regulations:

A. **Codes:** The design shall comply with the codes, standards, and regulations listed in Chapter 3 of these Design Standards, and at a minimum, with the most recent edition of all the codes that have been adopted by the State of Maryland. The technical requirements of these codes shall supplement all other standards, codes and regulations imposed by the University which may be initiated after the program preparation. The Environmental Health and Safety (EHS) Department is the appointed campus Occupational Safety and Health Coordinator and the UMB Fire Marshal and as such will review all design documents. When a specific project warrants variance from the governing codes and regulations, a request shall be submitted in writing to UMB at the Schematic Design Phase. Unless otherwise noted the latest edition of the codes in effect at the time the design contract is awarded will be used throughout the design and construction of that project.

B. **NFPA Codes:** The design shall comply with the codes listed in Chapter 3 of these Design Standards, and the following NFPA codes:

1. NFPA 54, National Fuel Gas Code, and ANZI Z223.1 latest edition adopted by the state of Maryland.
2. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, latest edition adopted by the state of Maryland.
3. NFPA 90B, Standard for the Installation of Warm Air Heating and Air Conditioning Systems, latest edition adopted by the state of Maryland.
4. NFPA 99, Standard for Health Care Facilities, latest edition adopted by the state of Maryland.
5. For NFPA Codes pertaining to fire protection see Fire Protection System Design of these Design Standards.

C. **Standards and Regulations:** The design shall comply with the standards and regulations listed in Chapter 3 of these Design Standards and the following standards and/or regulations shall also apply to all designs:

1. ASHRAE Standards as follows:

   a. ASHRAE Standard 15, Safety Standard for Refrigeration Systems, latest version.
   b. ASHRAE Standard 34, Designation and Classification of Refrigerants, latest version.
   c. ASHRAE Standard 62.1, Ventilation for Acceptable Indoor Air Quantity, latest version.
   d. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low–Rise Residential Buildings (ANSI ASHRAE Approved), latest version.
   e. ASHRAE Standard 90.2, Energy Efficient Design of Low–Rise Residential Buildings (ANSI ASHRAE Approved), latest version.

2. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), and American Society of Mechanical Engineers (ASME), latest edition.
3. **Pressure Vessel Inspections by the State of Maryland:** For the purpose of obtaining and having UMB buildings insured by any commercial insurance carrier, specify that the contractor shall arrange for the inspection of all pressure vessels installed during construction. The contractor shall contact the Office of Boiler and Pressure Vessel Inspections of the Department of Labor, Licensing and Regulations (DLLR), State of Maryland, and arrange for the inspections. The DLLR shall be notified at least thirty (30) days prior to installation. After such inspections are conducted by the State Inspector's office, Certificates of Compliance issued to the contractor of record shall be turned over to UMB for compliance with current insurance regulations as part of the Project Documents.

   a. **Examples:** Examples of pressure vessels include chillers, boilers, heat exchangers, converters, expansion tanks, water heaters, hot water generators and storage tanks. Chillers are also covered under AHRAE Guidelines.
   b. Specify that the contractor shall confirm that all pressure vessels are installed in full compliance with the requirements of the State Inspector's Office for Boilers and Pressure Vessels.
   c. The A/E shall use UMB's master mechanical specifications as a template for creating project-specific specifications. The above information is included in the master specifications. If, for some reason, the A/E is not using UMB's master mechanical specifications for the project, then the above information must be included in the A/E's mechanical specifications. UMB has developed

standard detail's for use along with the above information. This detail is available on the UMB website and shall be used as templates in creating project-specific details for the design documentation.

19.4 Coordination:

A. **Mechanical Design:** The mechanical design must be coordinated with architectural, structural, site civil, fire protection and electrical, and specialty designs to permit the A/E submissions and reviews by UMB to be made effectively. It is essential that the work of mechanical engineers does not lag unduly behind that of other disciplines. The engineer shall compile a list of all long lead items required for the project identifying those that may threaten the anticipated construction schedule.

B. **Site Visits:** On a renovation or alteration project, the engineer shall make visits to the site to ensure coordination with existing work and to make certain that there is adequate space and service clearance for the proposed layout and equipment. The engineer shall not rely solely on original construction document or earlier renovation drawings, as they may not represent the actual existing conditions. The A/E team shall check building dimensions to confirm the accuracy of archived record drawings.

19.5 Economical Design:

A. **General:** Mechanical systems shall be designed to permit acceptable competitive bids. Equipment and systems shall be efficient and economical for construction, operation, and maintenance. Where economic justification is required for mechanical work, the analysis shall be in accordance with life cycle costing methodologies as required in the UMB Procedure Manual for Professional Architectural and Engineering Services for UMB Construction and UMB Service Centers, latest edition.

B. Economic and Energy Analysis:

1. In the preliminary analysis, identify alternates that appear sufficiently promising to warrant detailed analyses. Use block loads, unit prices, and engineering judgment in their preparation. This analysis must be included with the A/E's design development submission, unless waived by UMB.
2. **Life-cycle Cost:** Unless waived by UMB, conduct a life-cycle cost economic analysis for each new building project and for each alteration project requiring a mechanical system. For new HVAC systems, the A/E shall evaluate the requirements for heating and air-conditioning on an integrated basis.
3. **Annual Energy Consumption Estimating Procedures and Equipment Sizing:** Base energy use projections and equipment sizing on calculation methodologies addressed in ASHRAE Handbooks.
4. **UMB - Approved Alternates:** Detailed analysis of alternates selected by UMB shall be submitted with the design development submission. All estimates of first cost, replacement costs, energy use/costs, maintenance impact/costs, and other issues shall be quantified and evaluated.

C. **Equipment Selection:** Equipment specified should be nonproprietary, except where no other source is available or as directed by UMB to meet performance requirements. Where a proprietary selection is deemed necessary, a request shall be submitted in writing to UMB early in the design stage. Materials selected shall be suitable for the application and shall be coordinated with other aspects of the project. Equipment such as fans and pumps shall be selected in their mid range of operation to allow for field adjustments and future capacity expansion.

D. **Fuel Selections:** Operating equipment shall use fuels in accordance with the following criteria

1. When possible, use electrical sources in lieu of district steam or CO2 producing fuel. Verify CO2 requirements with project scope and UMB Project Manager.
2. **Availability and Reliability:** Consider fuels which are readily available and free of restrictions in supply and use.
3. **Selection:** Fuel selection shall be made part of the economic selection requirements of the associated equipment. Use actual fuel prices associated with the specific site in lieu of regional or national averages.
4. **Type:** Consider any available fuel or form of energy if it can be obtained from normal sources of supply and meets air pollution standards. District Steam generated by Vicinity Energy is commonly used in existing buildings. Fuel selection shall be subject to UMB review and approval.

19.6 General Design Considerations:

A. **Electronic Drawing Files:** The A/E shall prepare electronic design drawings, utilizing the UMB standard drawing templates, in accordance with Chapter 28 of these Design Standards. The UMB standard drawing templates can be accessed through the UMB Design & Construction web page

B. **General Project Files:** Non-CAD type project files such as fee proposals, studies, reports, cost estimates, calculations, and specifications shall be submitted to UMB electronically as part of the project closeout document requirements. For additional requirements see Chapter 28 of these Design Standards.

C. **Floor Plans and Details:** Full size floor plans shall be drawn to a minimum scale of one eighth (1/8) inch per foot. Floor plans for mechanical equipment rooms, main electric room, electric rooms, BDF & IDF rooms, server rooms, emergency generator room, fire command center and all other areas where space conditions are such that close coordination between all disciplines is necessary shall be drawn to a minimum scale of one quarter (1/4) inch per foot. Where scaled details are necessary to indicate coordination between materials and equipment utilize a minimum scale of one half (1/2) inch per foot. Drawings shall be coordinated with the respective trades, and cross-sections and elevations provided. All floor plans shall include room numbers and room names as indicated on the architectural drawings. Where partial floor plans, sections and elevations are utilized for projects, these floor plans shall be developed at a minimum scale of one quarter (1/4) inch per foot for each discipline and include the floor name in the title of the part plan. If there is more than one part plan on a drawing, identify each plan with a number for reference purposes between floor plans and detail pages.

D. **Sustainability and Green Building Policy:** UMB encourages the integration of sustainable and green building practices in the design of all renovation and new building projects, regardless of the intent to meet LEED™ certification requirements.

1. The A/E team is encouraged to investigate and recommend the use of innovative and state-of-the-art use of materials, equipment, systems, and design approaches that hold promise for increases in energy efficiency, resource reuse and recycling, reduced energy consumption, and improved indoor air quality, operational efficiencies, and thermal performance of the project space.
2. Where the intended use of such design practices conflicts with these Design Standards, the A/E team shall notify UMB during the Schematic Design phase, or as soon as possible thereafter, so that a discussion of the issues can be held and resolution can be reached.
3. The engineer shall explore opportunities for the integration of discipline specific initiatives for sustainable design in the project as the design effort progresses. Specific design initiatives in the mechanical design could include, but are not limited to:

    a. Use of recycled and salvaged materials and equipment.
    b. Use of recyclable materials, use of sensible cooling systems for equipment loads such as chilled beams.
    c. Use of local unitary equipment to permit local control and operation, water cooled compressorized equipment for concentrated sensible loads, low flow plumbing fixtures, collection.
    d. Use of storm water and grey water.
    e. Alternate energy systems such as solar thermal, photovoltaic, and wind.
    f. Integration of raised floors for future flexibility and ease of utility routing.
    g. In addition, the A/E shall include requirements for recycling of demolition and construction waste materials in the construction documents.

E. **Pipe System Locations:** On each submission the location of all pipe systems and routing shall be shown as nearly as possible to the location where the systems are intended to be installed. In general pipe systems should be indicated on floor plans by single line representation for horizontal runs, with circles for risers and/or and half circles for drops. For sections, and elevations piping systems shall be indicated utilizing the same system representation used for the floor plans. Where piping systems, fittings and valve sizes are eight (8) inches and larger, said components, shall be indicated as double line, to scale,

F. **Duct System Locations:** On each submission the location of all duct systems shall be shown as follows:

1. **SD & DD Submissions:** Main duct systems, twenty four (24) inches in width and larger, including risers, representing existing and/or new ductwork shall be indicated as double line, to scale with appropriate sizes noted. Duct systems intended to be demolished shall be indicated as single lines with appropriate sizes noted. Portions of duct systems less than twenty four (24) inches in width can be represented by single line with appropriate sizes noted.
2. **50%, 95% and 100% Submissions:** All duct systems, new and existing including risers shall be indicated as double line, to scale with appropriate sizes noted on all floor plans, sections, and/or elevations.

3. On all submissions each duct system, and duct routing shall be shown as nearly as possible to the location where the systems are intended to be installed.

G. **Interferences:** Coordinate the design with the structural and architectural system components to avoid interference and conflicts. Particular attention shall be given to avoidance of structural components, including beams, columns, bracing, column caps and concrete reinforcement, and to ensure that all equipment and distribution systems fit adequately above intended ceiling heights. Coordinate the routing of all systems with all work of other disciplines. Consider space required for access for maintenance and repair of equipment.

H. Sleeves:

1. All penetrations through floors, walls, partitions, and roofs shall have sleeves. All sleeves and openings shall be sealed. All fire/smoke sealants for penetrations through rated fire/smoke assemblies shall be as described in the Architectural Division.
2. Coordinate with the structural engineer to ensure that structural working drawings show sleeves for pipes and ducts passing through footings, beams, and exterior walls below grade. The elevations of sleeves on foundation drawings must be given.

I. **Floor Penetrations:** All mechanical pits, cleanouts, manholes, trenches, etc., shall be shown on the structural plans. If membrane waterproofing is used, waterproofing under basement toilet rooms shall be dropped far enough to permit running the soil and waste pipes above the waterproofing to reduce the number of pipes passing through the membrane. Drainage piping required in connection with pressure slabs, and locations of pipes and sleeves passing through or under pressure slabs, shall be fully coordinated with the structural design.

J. **Foundation Drawings:** If construction of a foundation is to proceed in advance of completion of the superstructure drawings, separate working drawings of foundations are required. These drawings shall show:

1. Mechanical work that cannot be installed later. This includes piping and conduits below or through foundations, slabs, etc.
2. Later installation of mechanical work, including, but not limited to, sleeves, openings, chases, and trenches.

19.7 Specifications, Substitutions And Details:

A. **General:** In addition to the requirements in this section see the UMB Procedure Manual for Professional Architectural and Engineering Services for UMB Construction and UMB Service Centers, Latest Edition for submission requirements.

B. Mechanical Specifications:

1. A project specification incorporating sections for mechanical work shall be prepared, coordinated with drawings, and submitted. UMB has developed a complete set of master specifications for mechanical and electrical divisions, and selected architectural sections, and general requirement sections. The A/E shall review and select all appropriate sections from the UMB master specifications table of contents on the UMB web page. The A/E shall edit the UMB master specification sections to suit the requirements of the project. The A/E shall utilize their own specifications and/or other resources only in those cases where the UMB master specifications do not include the required equipment, materials, or construction

procedures to suit the current project. The UMB master specifications can be accessed through the UMB Design & Construction web page. All text in the header, footer and body of each specification section shall be “Times New Roman, Size 12”.

2. For UMB design projects that do not require a full set of mechanical specifications, UMB has a condensed version of mechanical specifications that should be used for these projects. The UMB condensed specifications can be accessed through the UMB Design & Construction web page.

C. **Substitutions:** For specification sections provided by the A/E that are not based on the UMB master specifications, the specification sections shall include the names of at least three manufacturers for every product. The engineer shall ascertain that every manufacturer listed is acceptable to UMB, and that every manufacturer listed can provide a product that is acceptable in terms of performance, quality, size, service access and orientation. Even though the engineer may identify one manufacturers’ product as the design basis, the other manufacturers’ product will not be viewed as substitutions, but as equals. In addition, other manufacturer’s products which are not listed, but can be considered as approved equals, shall not be viewed as substitutions. Only manufacturers’ products which are not approved equals because of a deficiency in one or more significant aspect of the product will be considered to be substitutions. The design shall include sufficient space and service clearance such that all equal products can be used.

D. **Mechanical Details:** The UMB engineering staff has developed a series of mechanical details, schedules, and system diagrams in CAD. These CAD files identify the required components and how UMB requires the equipment and systems to be installed and how UMB wants the equipment scheduled. These details shall be included in all construction documents. See the UMB Design & Construction website for a list of all available details.

19.8 Service Access:

A. **Access to Machines and Equipment:** Clearance shall be provided around machines and equipment to remove parts for repair or replacement. Additional considerations are as follows:

1. Door or window openings, removable panels in building walls, and corridors shall be arranged so that large machines or equipment parts can be removed or replaced without structural changes or movement of other equipment.
2. The engineer shall arrange with the architect to provide openings and passageways of sufficient size so that standard equipment can be used. Particular attention shall be given to equipment such as boilers, large tanks, refrigeration machines, air handlers, and condensers.
3. Water cooled chillers shall be located in an accessible at grade or below grade mechanical equipment room, and not on the roof or on upper floors.
4. The placement of operating equipment over ceilings shall not be used, with the exception of terminal units.
5. Requests for variance from this shall be submitted in writing to UMB early during the design process.

6. Accessible utility core spaces shall be provided for all major mechanical and electric utilities. Access through full-size man doors shall be provided.
7. These spaces shall have adequate clearance for maintenance and future replacement of the equipment, risers, and conduits with a minimum of three (3) feet between equipment and structural components or as in compliance with manufacturer's recommendations. Adequate space must be provided for possible future additional duct and pipe risers, conduits, and equipment.
8. Provide adequate clearance for filter replacement, coil pulling, and tube cleaning.
9. Designs which indicate the routing of piping or ductwork across the floor within the path of travel for service or maintenance personnel will not be acceptable to UMB, nor shall piping or ductwork be designed which would create a low clearance hazard.
10. There shall be a minimum of seven (7) feet vertical clearance within the path of travel. Where the path of travel is not obvious, or were directed by UMB, indicate the path of travel around all equipment requiring service access on the construction drawings.
11. UMB reserves the right to require a total or partial redesign of equipment layouts, at no additional cost or time delay, where the submitted design is, in the opinion of UMB Design and Construction Department, not in the best interest of UMB.
12. Coordinate with the electrical engineer to provide adequate lighting levels in all mechanical spaces for service and maintenance.
13. For additional access requirements for specific HVAC equipment see Chapter 22: Heating, Ventilation and Air Conditioning System Design.

B. **Parts Handling:** A suitable means shall be provided for lifting and moving cooler and condenser heads, fan sheaves, pump casings, strainer covers, motors, gear boxes, compressor casings, and similar parts weighing over fifty (50) pounds. The type of lifting equipment used in each case must be determined based on the number of machines in a group, size and weight of parts, accessibility, and estimated use. Typical means of lifting included in past designs have included monorails, davits, and provisions for portable cranes.

C. Overhead Equipment:

1. **Mechanical Rooms:** Catwalks, ladders, chain wheels, etc., shall be provided, as required, in mechanical rooms to provide access to material and equipment that cannot be accessed from the floor without the use of a ladder or lift. Overhead piping and equipment in high rooms shall, if possible, be arranged to permit grouping the maximum number of valves and other operating devices within reach of a short platform, catwalk, ladder, etc., or to permit orderly grouping of valve chains where they will not be hazardous obstructions. Where valves are not within seven (7) feet of the floor or catwalk, specify that valve chains shall be provided. This requirement includes all HVAC, plumbing and specialty valves. Where chains are not available; design the piping layout to bring the valve within seven (7) feet of the floor or catwalk. In addition, all piping strainers, control valves, and other fittings and equipment requiring periodic service shall be designed to be located within seven (7) feet of the floor or catwalk.
2. **Water Lines:** In general, do not locate pressurized water piping within electrical rooms, IT, F A and AV rooms. In other locations such as MER, Water lines shall not be installed over electrical panels or transformers.

3. **Above Ceilings:** Equipment such as pumps and air handling units shall not be located above ceilings, except for supply and exhaust terminal units, fan coil units, and fan powered boxes as approved by UMB. Design shall include required clearances for filter changing or other periodic maintenance.

D. Access Panels or Doors:

1. Panels or doors shall be provided for access to valves or other equipment requiring periodic service, access, maintenance, or examination above ceilings. The panels shall be a minimum size of eighteen (18) inches x eighteen (18) inches. For smaller ducts, specify that one side of the access door shall be a minimum of eighteen (18) inches in length.
2. Where access doors are provided as part of the HVAC equipment, such as in AHU's, these doors shall be large enough for the removal/replacement of coils, fans, fan motors, filter racks etc. The engineer shall arrange with the Architect to provide sufficient floor space for the maintenance and operation of the equipment. All such space shall be subject to approval by UMB.

E. **Service Access:** Design the locations of all traps, cleanouts, dielectric fittings, and other fittings requiring service such that they are accessible.

F. **Demonstration of Access:** At DD provide cut sheets for the three (3) selected units. The A/E shall include in the 50% submission at least three (3) specified manufacturer's equipment layouts demonstrating the adequate clearance, as deemed acceptable to UMB. The layout may need to include limited pipe connections to equipment.

19.9 Building Operation:

A. Except for selected shutdown holidays, UMB campus buildings are open to the public for business from 7:00 am to 6:00 pm, Monday through Friday, but many of the buildings on campus are occupied to a lesser extent at all hours of the day and night, seven (7) days per week. In buildings where public spaces and/or research spaces adjacent to the project area require other hours of operation, the design shall identify construction phasing that has the least impact on the adjacent occupied areas. The design shall include requirements for off-hour work as required for work involving the shutdown of systems or equipment serving the occupied areas.

19.10 Redundancy:

A. Where the program or design scope requires the provision of backup or redundant equipment, the mechanical design shall provide all necessary valves, controls, bypass piping, to permit independent operation of each piece of equipment. The design shall include all provisions necessary to permit isolation and removal of one unit while allowing the second unit to operate. Coordinate with the electrical engineer to ensure that all necessary disconnect switches, starters and isolation equipment, conduit and wiring is provided to permit independent operation. This includes the requirement for individual motor disconnects for every motor on packaged equipment with multiple motors and power connections.

19.11 Rotating Equipment:

A. All equipment with rotating parts shall be specified with complete guards as required by EHS. Obtain from UMB the EHS Guidelines for complete guides, which generally exceed those required by OSHA, and provide complete guarding of all moving parts as required by MOSH.

19.12 Demolition And Phasing:

A. **Demolition:** The A/E shall include all necessary provisions for demolition in the construction documents. Demolition shall include disconnection and removal of all equipment and distribution systems serving the project area.

1. For areas served by equipment and systems which also serve other areas not included in project scope, the design shall include demolition of distribution systems back to mains which must remain active for other areas.
2. All removed branch systems shall be identified to be capped or prepared for new branch connections to serve the project area as appropriate.
3. Where applicable the design shall include directions for all balancing and adjustments required to the main building systems affected by the project design as well as other components on the same system but located outside the project area. Include in the contract documents requireme0nt for the TAB contractor to provide pre-demolition measurements and post-construction measurements in the areas affected by the project. Coordinate with UMB.
4. Provide a list of all equipment and systems anticipated to be demolished, and those to be reused in the project design shall be submitted to UMB during DD for approval.
5. The A/E shall request from UMB a list of equipment to be identified as salvaged material to be turned over to the University for incorporation into the DD submission.

B. **Phasing Plans:** The A/E shall include phasing plans in the construction documents that indicate how the work in the occupied building can be accomplished with the least possible disruption to the occupants of surrounding and adjacent spaces.

1. The plans shall include provisions for all temporary piping, ductwork, power, equipment, and systems necessary to provide HVAC and plumbing services to all occupied areas interrupted by the construction work.
2. The plans shall also include the requirement for off-hour work for outages and disruption of all services to the occupied areas that cannot be accomplished during normal business hours. Most outages shall be scheduled during normal business hours unless otherwise directed by UMB.
3. The plans shall utilize, to the extent possible, the change of seasons in the calendar year to lessen the impact of system outages, performing work on heating systems in the summer months and performing work on cooling systems during the cold weather months.
4. The plans shall consider the anticipated disruption to adjacent occupied areas that will be caused by work that involves the generation of excessive noise, dust, and vibration.

19.13 Mechanical Equipment Room Layout:

A. **General:** The engineer shall work with the architect at the outset of the project to identify the sizes, shapes and locations of required spaces and dedicated equipment rooms for installation of all mechanical equipment. All mechanical spaces shall be designed to accommodate the required equipment in accordance with the manufacturer's operating and service clearance requirements, and in accordance with the accessibility requirements of these Design Standards. Equipment layout shall include space for efficient and economical transitions and connections to all equipment in accordance with good engineering practice. Provide a telephone outlet in each mechanical room. Coordinate the locations with the A/E team and UMB.

B. **Office Area:** Include in one (1) of the mechanical equipment room an office area approximately one hundred (100) square feet with a work desk, electrical receptacle, lock box, telephone, and PC workstation with a data outlet. This area shall be enclosed by a wire cage system for the walls, and ceiling, and a door with a lock.

C. **Stock Storage Area:** Include in the mechanical equipment room a storage area sized appropriately for a stock of maintenance materials to serve the equipment in the room.

D. **Separate Chiller Room:** Where refrigeration equipment is included in the design, a separate mechanical room shall be provided to house the refrigeration equipment to isolate and contain potential refrigerant leaks.

E. **Separation of Mechanical and Electrical Rooms:** Separation of mechanical and electrical rooms shall be maintained, with appropriate physical barriers to prevent flow or migration of fluids from mechanical to electrical spaces.

F. **Future Equipment Space:** When directed by UMB, or as required by the project program, provide space for future equipment such as chillers, pumps, and cooling towers. For future roof mounted equipment, the design shall include the necessary structural supports and roof penetrations for piping and conduits.

G. Housekeeping Pads: Provide concrete housekeeping pads for mechanical equipment intended to be floor mounted in mechanical rooms. Each housekeeping pad shall be constructed to support the operating weight of the equipment. The pad shall be at least four (4) inches high and extend at least three (3) inches beyond the equipment footprint on all sides. See UMB Mechanical Detail #54 for additional requirements.

19.14 Vibration And Noise Control:

A. Provide vibration isolation connections for all mechanical system components subject to vibration from rotating equipment such as fans, pumps, chillers, compressors etc. Design engineer shall use a combination of spring isolation hangers, neoprene pads, or floating isolation bases to control transmission of vibration to the surrounding structure. Equipment mounted directly on slab on grade construction with a house keeping pad typically does not require isolation from the floor slab. Provide spring isolation hangers on piping within the first ten (10) feet from the vibrating equipment. Provide a flexible connection for the electric service connection to the vibrating equipment.

B. In mechanical equipment rooms where the designed construction mass is not sufficient to provide a proper noise barrier, the engineer shall coordinate with the A/E team and UMB to ensure that the appropriate acoustical treatment of the mechanical equipment room in included in the design. To prevent excessive use of such treatment, the A/E shall consider placement of such spaces adjacent to unoccupied and transient spaces to use as buffer zones to assist in attenuating sound transmission. The location of such spaces shall be considered in the layout of spaces on each floor, as well as location on floors above and below critical spaces.
C. The mechanical system components shall be selected and/or acoustically treated to meet indoor space requirements. Prior to selection of all equipment and devices, the maximum noise level criteria for all spaces shall be submitted for UMB approval. Use noise levels as outlined in ASHRAE Standards.

19.15 Expansion And Contraction Compensation:

A. Provide a complete designed expansion and contraction system for each piping system, indicating the locations of all expansion loops and/or packless expansion compensators, all pipe guides and anchor points. Where pipe risers are anchored to the building structure coordinate those locations, and the anchoring designs, with the structural engineer. All necessary details and specifications are to be included in the contract documents. UMB prefers the use of expansion loops over compensators.
B. UMB prefers the use of expansion loops over compensators. Where pipe risers are anchored to the building structure coordinate those locations, and the anchoring designs, with the structural engineer. All necessary details and specifications are to be included in the contract documents.
C. Expansion joints with neoprene materials are not acceptable for hydronic heating systems.

19.16 Fire Stops And Smoke Seals:

A. Provide fire stops and smoke seals for all plumbing, fire protection and HVAC piping systems and ductwork that pass through rated floor slabs, utility shaft walls, and roof levels. Coordinate with the A/E team and UMB to ensure all code requirements are complied with.

19.17 Insulation:

A. **Indoor Piping, Ducts, and Equipment:** All indoor piping and equipment containing fluids hotter or colder than indoor design temperature shall be insulated, including all horizontal rain leaders. All piping carrying air conditioning condensate shall be insulated. Insulation shall have a vapor barrier, installed continuous through the supports, for all piping, ducts, and equipment with surface temperatures that will be below the anticipated worst case dew point temperature of the space in which they are located. Specify hangers and supports designed for insulated piping. Specify appropriate insulation blocking for supporting insulated piping in hangers.
B. **Exterior Piping**: All outdoor piping containing fluids hotter or colder than outdoor design temperature shall be insulated. Insulation shall have a vapor barrier, installed continuous through the supports, for all piping with surface temperatures that will be below the anticipated worst case outdoor dew point temperature. Specify hangers and supports designed for insulated piping. Specify appropriate insulation blocking for supporting insulated piping in hangers.

C. **Exterior Ductwork:** Insulate to conserve energy and prevent condensation, and support as needed.

19.18 Electric Motor Requirements:

A. Specify ECM motors with combination starter/disconnect for equipment with electric motors less than 5 HP. Specify VFD's for equipment using motors 7-1/2 HP and above. Coordinate requirements with Electrical Engineer.

B. Each motor, ten (10) hp or larger and/or motor-driven equipment shall have a composite Power Factor (PF) of 95% to 100% when the motor is operating at its rated full load capacity or 90% to 100% when operating at the design duty defined on the drawings. PF correction equipment, interconnection wiring, and connections shall be provided as part of the respective motor or motor-driven equipment whenever required to meet this requirement. Internal to the PF correction equipment, each branch circuit of the capacitor shall have a fast acting current limiting fuse. Also, each capacitor branch circuit fuse shall be provided with a blown fuse indicator consisting of a fused neon light which illuminates when a capacitor branch fuse has blown. The neon light shall be visible from the front of the enclosure with the door closed. A nameplate identifying the associated branch capacitor fuse shall also be included with each light. Provide an externally mounted molded case circuit breaker for over-current protection and isolation switching. PF correction devices shall be located as close as possible to the motors they correct.

1. For motors or motor-driven equipment requiring other than full-voltage starting, PF correction capacitors shall be connected to the motor terminals via a contactor (controller) with a 120 VAC coil. The 120 VAC coil shall be energized via an auxiliary contact on the contactor (controller) used to establish the "run" operating mode for the motor.
2. For two (2) speed motors, PF shall be corrected at each speed via separate groups of capacitors for each speed. Each group of PF correction capacitors shall be connected to motor terminals via a separate contactor (controller) with a 120 VAC coil. Each 120 VAC coil shall be energized via an auxiliary contact on the contactor (controller) used to establish "run" operation at each speed.
3. For variable frequency control (VFC) and associated motor-driven equipment, these two items are defined as a unit (one package) and the composite PF shall be the PF at the power input to the VFC for the respective unit. No PF correction shall be provided for motors controlled by VFC's.

C. Require shop drawings to be provided for each motor that include the following information:

1. Unit or motor data defining efficiency and PF at incremental loads (10% or smaller increments) from full load to no load without PF correction.
2. Maximum allowable PF correction capacitance which will not cause over-excitation at no load.
3. PF correction capacitance to be provided to comply with required PF correction.
4. Data on each component used to achieve required PF correction.
5. Data to enable calculation of motor load at design duty.
6. Value of full load amperes (FLA) with correction capacitance shall be provided and connected.

19.19 Emergency Power Requirements:

A. In addition to the life safety equipment and/or systems required by Code, include the following equipment and systems in the design of the emergency power distribution system that may apply to the project unless otherwise directed by UMB:

1. Preheat pumps and system.
2. Process cooling water pumps.
3. Fire pump.
4. Fume hood exhaust fans.
5. General exhaust fans.
6. AHU supply air fans as needed for make-up air for smoke evacuation Systems.
7. Atrium smoke evacuation systems.
8. A/C units, dry coolers and pump packages serving computer rooms, data rooms, IT closets, elevator machine rooms, electric rooms, Tela-Data, BDF, and IDF rooms.
9. Stair pressurization systems.
10. Controlled environment rooms.
11. Foundation sump pumps.
12. Fire alarm systems.
13. Domestic water booster pump package.
14. ATC controls for the above equipment and systems, including but not limited to, cabinets, TEC's, transformers, and ATC air compressor. Coordinate with UMB for additional requirements.
15. One (1) building elevator.

19.20 Special Use Areas:

A. Equipment Space Cooling Requirements:

1. **General Requirements:** Provide A/C systems to condition mechanical, electrical, elevator equipment rooms, computer rooms, server rooms IT closets, and Tela-Data and IDF rooms. These A/C systems shall be separate and independent from the general building systems as follows:

   a. The A/C systems serving mechanical rooms, electrical rooms, and elevator machine rooms must be able to operate on a twenty four (24) hour, seven (7) day schedule. Provide heating, cooling, and ventilation systems for these areas for periods of mild and cold weather. Provide emergency power for the A/C systems and controls serving these rooms.
   b. The A/C systems serving computer rooms, server rooms, Tela-Data and IDF rooms must be able to operate on a twenty four (24) hour, seven (7) day, three hundred sixty five (365) days per year cycle. Provide emergency power for the A/C systems and controls serving these rooms. The UMB Telecommunication Department or the IT consultant shall provide the A/E with the equipment loads for all computer rooms, server rooms, IT closets, Tela-Data and IDF rooms. Include in the design provisions for additional heat loads for future expansion and coordinate with UMB for additional requirements.

2. **Water Cooled Dx Cooling Only A/C Systems:** For equipment space cooling it is UMB's desire to utilize water cooled dx cooling only A/C units located in the rooms. These units shall be connected to a building process cooling water system. See Chapter 22: Heating, Ventilating and Air Conditioning System Design of these

Design Standards for additional requirements for process cooling water systems. The A/E shall specify that these A/C systems are to be controlled through the UMB building automation system.

3. **Glycol A/C Systems:** Where process cooling water systems are not available the engineer shall utilize glycol (40%) A/C systems with water cooled A/C units located in the room, a dry cooler and pump package located on the roof, and the necessary piping distribution system. The A/E shall specify that these A/C systems are to be controlled through the UMB building automation system. The system design shall be coordinated with UMB.
4. **Mechanical, Electrical and Elevator Machine Rooms:** Design the A/C systems to maintain an ambient temperature of 85^0F for these rooms.
5. **Tela-Data, BDF, IDF Computer, Server, and IT Rooms:** Design the A/C systems to maintain an ambient temperature of 75^0F @ 50% RH for these rooms.

B. Biological Safety Level 3 (BSL- 3) Facilities:

1. See Chapter 3: Building Codes and Review Agencies of these Design Standards for codes and requirements not included in this Chapter.

C. Animal Biological Safety Level 3 (ABSL- 3) Facilities:

1. See Chapter 3: Building Codes and Review Agencies of these Design Standards for codes and requirements not included in this Chapter.

19.21 Commissioning:

A. The A/E team shall include the requirement for commissioning of all mechanical, electrical, and appropriate building systems by an independent commissioning agent to be hired by UMB or the CM, as directed by UMB. The design specifications shall include all descriptions, commissioning forms, reports, and procedures required to completely test and demonstrate the operation of systems provided by the project. The testing and demonstration of each system shall include, at a minimum, normal operation and control sequences, failure modes, monitoring and control systems, life safety operations, security operations, and all remote monitoring and notification.

19.22 University Furnished Equipment:

A. When the project includes equipment that is furnished by the university, for installation by either the vendor or the contractor, the A/E shall include the required plumbing and HVAC rough – ins, for the basis of design equipment along with all necessary clearances as defined by the vendor. Also include necessary interfaces with the BAS. Coordinate with UMB for required points.

End of Chapter

Chapter 20: Fire Protection System Design

Amended 9-19-2022

20.1 Scope:

A. This part outlines the minimum requirements for the design procedures for fire protection systems, for new buildings, and repair and alteration projects for existing buildings on the UMB campus. See UMB Master Specifications, Division 23 HVAC for more detailed information for material, equipment, and installation requirements.

20.2 General Requirements:

A. All UMB buildings shall be protected with a sprinkler system which covers 100% of the floor area, and which meets the requirements of the State of Maryland Fire Protection Code and applicable NFPA Codes and Standards. Most fire protection requirements imposed by the State of Maryland are adopted by reference to national codes and standards developed by associations such as the National Fire Protection Association (NFPA), American Society for Testing and Materials (ASTM) American National Standards Institute (ANSI), and the International Building Code (IBC) with modifications. These codes and standards are considered requirements for the State of Maryland to the extent they are referenced, except where exceptions are noted. Special situations may require a different type of automatic fire protection system for localized areas, as listed herein. Coordinate with UMB Fire Marshal for selection of alternative systems.

B. Building Codes: Construction, repairs, and alterations shall be in compliance with state adopted nationally recognized model fire and building codes and standards. The referenced edition of these codes/standards shall be used.

C. Systems and Codes: Types of fire protection systems and applicable codes:

1. Carbon Dioxide Extinguishing Systems – NFPA 12.
2. Halon 1301 Extinguishing Systems – NFPA 12A.
3. Sprinkler Systems - NFPA 13.
4. Sprinkler Systems in Low-Rise Residential Occupancies - NFPA 13R.
5. Standpipe and Hose Systems – NFPA 14.
6. Water Spray Fixed Systems – NFPA 15.
7. Foam-Water Sprinkler and Foam-Water Spray Systems – NFPA 16.
8. Dry Chemical Extinguishing Systems – NFPA 17.
9. Wet Chemical Extinguishing Systems – NFPA 17A.
10. Wetting Agents – NFPA 18.
11. Fire Pumps – NFPA 20.
12. Private Fire Service Mains – NFPA 24

D. When required by the building design and/or applicable codes, UMB buildings shall be provided with a smoke evacuation system and/or stair pressurization systems, as required by NFPA 101 Life Safety Code.

E. Coordinate all system components with UMB, and the University Fire Marshal.

F. For protection of potable water systems see Chapter 21: Plumbing System Design of these Design Standards.

G. All sprinkler system designs shall be based on the UMB fire protection specifications. The "Occupancy Classification" shall be presented for discussion with UMB as such buildings or building portions are designed. The UMB Fire Marshal shall have final approval on identification of building occupancies.
H. The engineer shall perform necessary hydraulic calculations to determine water supply pipe sizes, pressures, and pressure drops to the most hydraulically remote area. For minor renovations, the UMB Fire Marshal may waive hydraulic calculations on a case-by-case basis. If the hydraulic calculations requirement is waived the design shall be based on the existing building pipe schedule. The engineer needs to provide direction if the design will be based on the existing building pipe schedule or hydraulic calculations are required.
I. The intent of the A/E Design is to provide enough information on the contract document so that the contractor can accurately bid the project based on the plans and specifications.
J. The following information shall be provided on separate fire protection drawings:

    1. For a combination standpipe and sprinkler system, the document shall contain applicable items from the list below:

        a. Flow test data. The A/E shall make arrangements for a flow test to be performed during the design.
        b. Sizing of fire service to building.
        c. Location of backflow preventer.
        d. Sizing of fire pump, if required.
        e. Fire pump room layout.
        f. Type of fire/jockey pump controller.
        g. Sizing of standpipe.
        h. Location of floor control valves.
        i. Pressure rating of piping and valves.
        j. Location of tamper and flow switches.
        k. Return bends required at typical drop to pendent sprinkler heads.
        l. Location of fire department connection, alarm check valve, fire pump test header, all system drains and fire department hose valves.
        m. Location of building supply mains and standpipe risers (with sizes).
        n. Provision for forward-flow test of backflow preventer.

    2. System Diagram: Provide a complete diagram of the fire protection system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

K. The engineer shall specify the following contractor requirements:

    1. Contractor Responsibilities:

        a. Flow test data, independent of A/E flow test.
        b. Provide a complete and operable system in accordance with NFPA codes and local regulations.
        c. Provide working drawings in accordance with NFPA codes.
        d. Complete sprinkler piping and head layout downstream of the fire entrance riser and/or floor control devices at each floor.
        e. Coordinate routing of piping with other disciplines and building structure.

L. The engineer shall incorporate the UMB fire protection specification into the project construction documents. This UMB specification shall be edited and formatted by the engineer to suit the project requirements.

20.3 Water Supply Requirements:

A. Types of Water Supplies: The water supply system shall provide ample water to meet the needs according to NFPA. There are two (2) types of fire protection demands as follows:

1. Hose stream allowance.
2. Automatic sprinkler systems.

B. Fire Department Connection: Only one (1) fire department connection shall be provided for any building that has a sprinkler system or standpipe system. In new construction, standpipe and sprinkler systems shall be interconnected so that each fire department connection will serve all fire protection needs simultaneously. Where the building faces on more than one street, additional fire department connections may be required. Coordinate with the UMB Fire Marshal during design.

C. Deficient Water Pressure: If the available water supply lacks the required water pressure to meet the system design, a fire booster pump shall be provided.

D. Hydrants and Mains: When necessary to provide fire hydrants, valves, or underground fire mains, the material, installation, and location shall meet the requirements of NFPA 24, and Baltimore City Department of Public Works.

E. Fire and Booster Pumps: Fire pumps, booster pumps and their related electrical controllers shall meet the requirements of NFPA 20 and NFPA 70. The engineer shall include in the fire pump design a fire pump test header to facilitate fire pump flow tests. The discharge for the test header shall be piped to discharge outside near grade.

F. Public Water Main Connections: Connections to public water mains shall be sized to provide the required water demand for the fire protection system. During the design process the engineer shall verify through appropriate analysis, calculations, and consultation with the appropriate Baltimore City Departments and the UMB Fire Marshal, the adequacy of the existing water supply mains to provide the necessary flow rates. See Chapter 21: Plumbing System Design of these Design Standards for water meter requirements.

G. Sprinkler System Devices: Required sprinklers shall be connected to a vertical fire riser system in accordance with NFPA 13. The sprinkler system connection shall be equipped with a water flow alarm connected to the building fire alarm system. An inspector's test shall be constructed as one self-contained unit, and valve tamper devices shall be provided. Valve tamper devices shall transmit a supervisory signal to the building fire alarm system.

H. Fire Department Hose Connections: Provide two and one half (2-1/2) inch fire department hose connections at each floor level off the fire main riser. Provide a two and one half (2-1/2) inch to one and one half (1-1/2) inch reducer with an easily removed cap on each two and one half (2-1/2) inch Fire Department hose connection. These threads shall also be compatible to the Baltimore City Fire Department hose.

20.4 Automatic Sprinkler Protection:

A. Coverage:

1. Automatic sprinkler systems shall be provided for the entire project area.

2. Automatic sprinkler systems shall be installed in accordance with NFPA 13 and UMB master specifications.
3. Wherever partial coverage sprinkler systems are required by the program scope, the sprinklered area shall be separated from the unprotected areas by fire rated construction materials. Coordinate this requirement with the architect.

B. Systems:

1. All sprinkler system installations shall be of the wet type, except:

   a. Where sprinkler protection is required in unconditioned areas, such as loading docks or attic spaces, the A/E team shall specify a dry pipe or pre-action sprinkler system and all necessary components for these types of areas. Dry pipe or pre-action type sprinkler systems shall include a nitrogen generator and air compressor either located in a cabinet or floor mounted.

C. Sprinklers:

1. Quick Response Sprinklers: Quick response commercial type sprinklers shall be used in all new sprinkler systems and in renovation areas where modifications to existing sprinkler systems are required.
2. High Temperature Sprinklers: High temperature commercial type sprinklers shall be used in areas where sterilizers, glass washers and/or cage washers are installed.
3. Special Considerations:

   a. In areas of the building where local control of the sprinkler system is required, provide a shut off valve with a tamper switch in the sprinkler piping serving the area. This valve and tamper switch must be accessible. Examples of areas requiring local control are:

      i. Computer Main Frame Rooms.
      ii. Library Book Stacks.
      iii. Rare Book Rooms.
      iv. Elevator Shafts.
      v. High valuable areas.

   b. The local control valve may be located above the ceiling or installed in a recessed wall cabinet, as directed by UMB and/or the UMB Fire Marshal. The local valve shall always be located outside of the room or area served.

20.5 Smoke Control Systems:

A. Smoke control systems shall be completely engineered systems in accordance with accepted engineering practice and in compliance with Section 9.3 of the NFPA 101 - Life Safety Code. Where allowable and economically feasible, these systems shall utilize the existing or new HVAC components as appropriate. Where the engineered smoke control system includes smoke evacuation or exhaust, provisions shall be made for positive introduction of outside make-up air. These systems shall not rely on window or door openings for make-up air. Approval of the design shall be subject to review and acceptance by UMB and the UMB Fire Marshal. Provisions shall be included for initial acceptance and periodic testing and demonstration of performance of the systems, including appropriate documentation of all pertinent performance criteria.

B. Provide an on-off-auto switch for the smoke control system on a smoke control panel, installed adjacent to the fire alarm control panel.

20.6 Stair Pressurization Systems:

A. Stair pressurization systems shall be completely engineered systems in accordance with accepted engineering practice and in compliance with Section 9.3 of the NFPA 101- Life Safety Code. These systems shall be designed to be completely independent of all other HVAC Systems. These systems shall not be provided with any heating, cooling, or filtering equipment or coils. Approval of the design shall be subject to review and acceptance by UMB the UMB Fire Marshal. Provisions shall be included for initial acceptance and periodic testing and demonstration of performance of the system, including appropriate documentation of all pertinent performance criteria.

End of Chapter

Chapter 21: Plumbing System Design

Amended 09-19-2022,

21.1 Scope:

A. This part outlines the minimum requirements for the design procedures for plumbing systems, for new buildings, and repair and alteration projects for existing buildings on the UMB campus. See UMB Master Specifications, Division 22 Plumbing for more detailed information for material and equipment.

21.2 Building Distribution Systems:

A. **General:** Building distribution systems include storm water systems, A/C condensate systems, sanitary systems, acid waste systems, domestic cold and hot water systems, laboratory cold and hot water systems, natural gas systems, laboratory compressed air and vacuum systems, laboratory specialty gas systems such as CO2, nitrous oxide, and oxygen and RO/DI water systems.

21.3 General Design Considerations For Sewer And Water Systems:

A. **Building Sewer Systems:** Provide separate sanitary and storm systems on the site and throughout the building.
B. **Building Water Service:** Provide separate water services for the domestic water and fire protection systems. Installation of water source shall comply with the City of Baltimore Procedures and Standards, in addition to the requirements of these Design Standards.

1. For large campus buildings, two sources of water from different mains are desirable, as determined by UMB.
2. Service lines must enter the building in an accessible location, and must never enter fuel rooms, storage rooms, switchgear rooms, or transformer vaults. Provide a water strainer at service entrance for the domestic water system as required to improve the incoming water quality.
3. **Building Automation System Flow Meter:** Include an IP based reportable flow meter in the main domestic cold water service inside the building to measure the total GPM flow rate and transmit the recorded flow to the building automation system (BAS). For additional metering requirements see Chapter 22: Heating, Ventilating and Air Conditioning System Design 22.18 Automatic Temperature Control of these Design Standards and coordinate with UMB.
4. **Water Meter Requirements:** The building water supply shall include an exterior meter vault. The location and construction shall comp the Baltimore City Standards. The meter vault shall house two (2) water meters, one meter shall serve the building's domestic water service and the other meter shall serve the building's fire protection service. For additional requirements for the building's fire protection service see Chapter 20: Fire Protection System Design of these Design Standards.

21.4 Sanitary System:

A. **General:** UMB requires that all sanitary waste and vent distribution piping above grade within the building shall be cast iron no hub material as specified in the UMB master specifications. For sanitary waste piping below grade UMB requires cast iron bell and spigot material as specified in the UMB master specifications. Special waste shall be as defined herein.

B. Floor Drains:

1. **General:** Floor drains shall be installed in mechanical equipment rooms, kitchens and dishwashing areas, animal holding rooms, BSL-3 and ABSL-3 rooms, toilet rooms, rooms containing back flow preventers, garages, and similar areas. Coordinate types of floor drains with floor finish material.
2. **Location:** Floor drains shall be located near the equipment served to minimize surface water flow and to avoid crossing path of travel with surface flow or low drain piping. Number and locations of floor drains shall be provided to avoid standing water.
3. **Connection to Drainage Systems:** All floor drains, except those, exclusively collecting storm water, shall drain to the Sanitary System.
4. **Trap Primers:** Floor drains connected to the sanitary system shall be provided with trap priming systems. In rooms such as toilet rooms where there is a single drain the trap can be primed through a local trap priming valve or through a connection from a flush valve. Where multiple floor drains are located in a large room the floor drains shall be primed by an automatic priming system including a timer, distribution manifold, single water and power connection mounted in a panel.
5. **Venting of Floor Drains:** Of special note is the procedure for venting floor drains, floor sinks and other floor level fixtures. Although governed by the applicable section in the Plumbing Code, UMB will not accept designs which include horizontal vent piping below the floor level rim of the fixture. A vent which rises off the horizontal sanitary line from the floor drain and turns horizontal or slightly inclined below the floor slab will not be acceptable. Circuit venting or combination drain and venting shall be used if necessary to avoid this condition.

C. Cleanouts:

1. As a minimum requirement provide cleanouts in the sanitary system as required by the State Plumbing Code. In addition to the requirements of the Plumbing Code cleanouts shall be provided at the ends of horizontal waste piping located in pipe chases that serve wall mounted plumbing fixtures in toilet rooms. Locate the cleanouts for the horizontal piping in a vertical position at a height above the grab bar. Access doors in the wall or partitions will be required at these cleanout locations.
2. In finished spaces, the cleanout access cover shall be coordinated with UMB. Do not install cleanout fittings in floors of toilet rooms. Avoid locating cleanouts in main finished public spaces if possible. Adjust the routing of horizontal piping to avoid this condition.
3. Care shall be exercised to position cleanouts in accessible locations.

D. Sewage Ejectors:

1. Do not use sewage ejectors if other methods can be employed to allow gravity flow. If feasible, locate toilet facilities on upper floors. If ejectors are required, only lower

floor facilities shall drain to them; upper floor facilities shall drain by gravity to the main sewer.

E. Special Wastes:

1. Separate drainage and vent systems for acid wastes shall be of corrosion-resistant material as specified in UMB master specifications, or as directed by UMB A/E staff. Where an acid waste piping system is appropriate; design a separate piping system to the point of exit from the building. At this point, combine with the general building sanitary system and discharge to the city's sanitary system. Do not indicate or specify the use of a neutralization system for acid waste systems.

F. Fixture Venting:

1. As described for floor drains, horizontal vent piping below the flood level rim of fixtures will not be acceptable to UMB. For island sinks, horizontal vent piping below the counter top will not be permitted.

G. Fixture Layout:

1. Fixtures shall be located to avoid back-to-back installation to eliminate cross fittings in the sanitary piping. Cross fittings shall not be used.

H. **System Diagram:** Provide a complete diagram for each waste and vent system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

21.5 Storm Water System:

A. **General:** UMB requires that all storm water distribution piping above grade within the building shall be cast iron no hub material as specified in the UMB master specifications. For storm water piping below grade UMB requires cast iron bell and spigot material as specified in the UMB master specifications. For garage structures specify that all above grade storm water piping, fittings, cleanouts, and hangers must be galvanized.

B. Roof Drains:

1. **Types:** Coordinate with type of roofing system specified. Drain bodies and grates installed in parking garage structures must be galvanized.
2. **Locations:** Coordinate locations with architectural requirements and as per the Plumbing Code. Sizing should be based on maximum anticipated rate of rainfall permitted by the Plumbing Code.
3. **Secondary Drainage Systems:** Provide a secondary roof drainage system, sized for a one hundred (100) year, fifteen (15) minute storm duration as required by the plumbing code. When roof areas include parapet walls design scupper drains to discharge the excess water through the parapet wall. When roof areas do not include parapet walls design secondary roof drains to discharge the excess water down the face of the exterior wall.

C. Cleanouts:

1. Provide cleanouts in the storm water system as required by the Plumbing Code.
2. Refer to the paragraphs on cleanouts in the sanitary system section for additional requirements.

D. Sump Pumps:

1. Sump pumps shall not be used where gravity drainage methods can be employed.
2. Where sump pumps are necessary, provide a duplex sump pump arrangement with a pit employed below the floor; size each pump for full flow. Only drainage systems that cannot be drained by gravity shall be drained to a sump pump. Submersible pumps or high and dry pumps are to be considered. Coordinate with electrical engineer to provide emergency power for sump pumps.
3. All new projects with hydraulic elevators are required by the State of Maryland DLLRS to have sump pumps with oil separators on the discharge of the sump pumps.

E. Steam Condensate:

1. As further described in Chapter 22: Heating, Ventilating and Air Conditioning System Design of these Design Standards, the residual heat from steam condensate shall be recovered prior to discharging into the storm water system.

F. A/C Condensate: Condensate from air conditioning equipment shall be discharged into the buildings storm water system. Where A/C condensate drains cannot be gravity drained into the storm water system, the condensate shall be discharged into sump pit and pumped into the storm water system.

G. Insulation:

1. Horizontal interior rain leaders and drain bodies shall be insulated to preclude condensation and associated damage.
2. Drains that have chilled water condensate must be insulated to eliminate sweating.

H. **System Diagram:** Provide a complete diagram for the storm water system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

21.6 Water Supply System:

A. **General:** UMB requires all domestic cold and hot water distribution piping above grade within the building to be cooper pipe tube and fittings as specified in the UMB master specifications.

B. Building Water Services:

1. Pressure piping for domestic water and fire protection services shall not be permitted under building floor slabs that are installed on grade. Any deviation from this standard must be submitted to the UMB Project Manager for review and approval.
2. When designing the domestic water piping system attention should be given to ensure piping is not located over electrical equipment such as panels, motor control centers and other such electrical devices.
3. When automatic faucets are included in the design the engineer shall provide a central tempered water system which includes a thermostatic mixing valve and check valves in the incoming cold and hot water supplies. System design must be coordinated with UMB.

C. Water Pressures Requirements:

1. **Municipal Water Pressure and Flow:** Coordinate with Baltimore City Water Department for determination of water pressure and flow. Typically, it is UMB's experience that the street level water pressure from the city system is 55 psi or less.

2. **Minimum Water Pressure:** The minimum water pressure required, for uses other than fire protection; on a typical floor of a building is 30 psi, or more if required for specific equipment. On the Roof Level provide 50 psi water pressure for maintenance to service roof mounted mechanical equipment.
3. **Booster Pump System:** If street pressures are not adequate to maintain pressures indicated above, provide a booster pump, a pneumatic system, a constant pressure, or a maintained pressure pumping system with staged pumping units to provide pressure control and redundancy. Provide an analysis and comparison of initial, operating, and maintenance costs in the design development submission with a recommendation for system selection. This system shall be designed to serve only portions of the water supply system where street pressure is inadequate.
4. For fire, sprinkler, and standpipe systems, see Chapter 20: Fire Protection System Design of these Design Standards.

D. Domestic Water Piping System:

1. **General:** Do not place water piping in exterior walls, floor fills, structural slabs, above ornamental suspended ceilings, transformer vaults, or over switchboards, except for fire sprinkler system piping. Avoid extended runs of water piping in unheated garages or soffits, as heat-tape applications can result in substantial energy use.
2. **Backflow Protection:** Provide backflow protection for water piping systems. Protect water distribution systems against backflow (flow of water or other liquids into distributing pipes from a source(s) other than the intended sources), including HVAC make-up water systems. Refer to the current Baltimore City Requirements and the following:

    a. Provide a second, backup backflow protection in bypass piping for the main building service and on critical need systems.
    b. Provide backflow protection at connections to all equipment.
    c. Provide separate, serviceable, accessible check valves on both hot and cold water connections to all tempering valves, shower mixing valves, single spout service sink faucets, photo processing equipment, fixtures with single lever faucets and all other fixtures where directed by UMB.
    d. When sizing the distribution system and determining pressure requirements, the engineer shall take into account the pressure drop through backflow preventers and water meters.
    e. The locations of all backflow preventers shall be shown on the construction drawings. Since backflow preventers require periodic inspection, maintenance, and testing, they should be located in appropriate, accessible locations.
    f. Backflow preventers shall not be mounted higher than forty eight (48) inches above the floor.
    g. Location above ceilings is not acceptable.
    h. Drains from the backflow preventers shall be piped directly to a floor drain. The floor drain and drain piping must be sized to accommodate the pressure and flow rate of the RPBLP as identified by the manufacturer.

3. **Pressure-Reducing Valves:** Pressure-reducing valves (PRV) shall be installed on domestic / laboratory water mains or branches where pressure in excess of 70 psi is expected. Provide a valved bypass, one pipe size smaller than the main size, around

the pressure-reducing valves with isolation valves for removal of the PRV. Specifications shall state the initial pressure, required flow, and final pressure. The pressure reducing valves shall be located in accessible mechanical spaces only, and not above ceilings.

4. **Exterior Wall Hydrants**: Provide wall mounted frost-proof exterior wall hydrants above grade for lawn hoses so that any part of the building site may be reached with one hundred (100) feet of hose without having the hose cross building entrances. Provide shut-off valve on piping serving each wall hydrant. Pitch piping from shut-off valves to drain through hydrant.
5. **Roof Level Wall Hydrant:** Provide wall mounted frost-proof exterior wall hydrant(s) for servicing mechanical equipment above the Roof Level. Provide shut-off valve on piping serving each wall hydrant. Pitch piping from shut-off valves to drain through hydrant. See paragraph 6.3 for water pressure requirements.
6. **Interior Hose Bibs:** Provide hose bibs in janitor closets, mechanical equipment rooms, and animal holding rooms for maintenance and housekeeping. The water service for the hose bibs in mechanical rooms must be independent from the HVAC make up water systems.
7. **Vacuum Breakers:** Vacuum breakers shall be included on cold and/or hot water branch piping serving fume hoods, biological safety cabinets, and hose bibs. Where vacuum breakers are installed in partitions, provide a recessed wall cabinet with an access door. All vacuum breakers shall be accessible.
8. **Janitor Closets:** Provide a cold water connection with shut off valve and a reduced pressure backflow preventer for a university supplied chemical dispersion unit for housekeeping. See UMB Standard Detail.
9. **System Diagram:** Provide a complete diagram for each water system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.
10. Domestic Hot Water:
    a. For general plumbing and laboratory plumbing use, equipment shall be automatically controlled and shall have sufficient capacity to deliver 120^0F water to single-temperature faucets at the point of use.
    b. Fuel or energy selected for water heating shall be determined by availability and cost. The type selected may be steam, gas, electricity, or solar, but is subject to UMB's review and approval.
    c. Heater size should be in agreement with the latest ASHRAE Handbook.
    d. The design engineer shall utilize all available heat energy from steam condensate, and flash steam to preheat domestic water. Provisions shall be made to temper the supply hot water temperature to 120^0F as necessary.
    e. Provide a separate domestic water heating system to supply high-temperature water to kitchen equipment, glass wash, and special use areas.
    f. Separate recirculating domestic hot water systems shall be designed for general plumbing and laboratory plumbing, with hot water produced from separate generators.
    g. For high rise buildings provide separate water heaters, recirculation pumps, and distribution systems for municipal water pressure service and boosted water pressure services. Create separate pressure zones for domestic/laboratory hot water distribution.

11. Provide water hammer arrestors as needed where water hammer is anticipated. Show the locations of all arrestors on the drawings and locate them in accessible areas. Provide access doors.
12. Piping Limitations:

    a. Domestic water shall not be used as a condensing fluid. This restriction applies to refrigeration units of any size. Exception: When the design scope or UMB requires water cooled refrigerant equipment such as A/C units for supplemental cooling or for walk-in cold boxes, provide an emergency connection to the domestic water system and a drain outlet piped to a floor drain as directed by UMB facilities management staff. The emergency supply and drain shall be a manual operation by UMB personnel.

E. Valves:

1. Locations and types of valves must be shown on drawings, be accessible, and be identified with suitable markers. The use of gate valves for plumbing and HVAC systems are not acceptable to UMB. See UMB master specifications for acceptable valve types.
2. Install valves on cold water, hot water, and hot water return circulating mains so that sections of mains may be shut off without disturbing the services to other parts of the building. At a minimum provide isolation valves to isolate the distribution piping serving each floor from the main building risers. In addition, a valve shall be provided on the main supply at its entrance to the building and on inlets and outlets of mechanical equipment requiring water connections. During both new construction and renovation design, particular care shall be taken to ensure that there are no dead end piping runs.
3. Install a shut-off valve close to the main on each branch connection off the main serving more than one fixture. Provide valves at the base of risers when served from below, or the top of risers when served from above.
4. Install a valve on the supply to each toilet room where the riser supplies more than one toilet room, and on the connection to each wall hydrant. Provide drain valves with hose ends at the low points of systems, in all trapped portions of piping systems, and at the base of risers.
5. Provide valved and capped connections per floor in the water distribution system for future expansion. Coordinate with UMB for number, size, and locations of future connections.
6. Piping system designs must include locations of low point drain valves on floor plans, sections, elevations, diagrams, details, etc.

F. Fire Protection System:

1. Plumbing systems shall be coordinated with the requirements of fire protection systems, which may include automatic sprinkler systems, fire pumps, fire standpipes, fire hydrants, mains, water tanks, or fire department connections.
2. Extreme care shall be taken to ensure that potable water for the domestic system is maintained. The design shall require safety precautions, such as backflow preventers and other safety devices, to protect the domestic water system when cross-connections are made with other systems.
3. For fire protection requirements, see Chapter 20: Fire Protection System Design of these Design Standards.

4. **System Diagram:** Provide a complete diagram for the fire protection system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

G. Emergency Showers and Eye Wash Stations:

1. Provide emergency showers and eye wash stations as required by Laboratory Design Guides, program requirements, applicable Code Requirements, and good design practice. All emergency showers and eye wash stations shall be supplied from the domestic cold water system.

21.7 Natural Gas Systems:

A. General:

1. Natural gas piping systems shall be designed to meet the requirements of NFPA 54, latest edition.
2. Provide gas booster system where required to maintain adequate pressure at point of use. Coordination with Baltimore Gas Electric Co. (BGE) to determine gas availability and pressure shall be performed by the A/E.

B. Ventilation:

1. Ventilate gas meter rooms and places containing major gas-supplied equipment, such as gas-fired boilers, gas-engine emergency generators, or other equipment using large quantities of gas, to ensure removal of leaking gas.

C. Natural Gas Piping Systems:

1. Provide a natural gas piping distribution system to all gas fired equipment. Provide valves for isolation from other gas systems.
2. Provide a natural gas piping distribution system to all research laboratories. Include valves for isolation from other gas systems. Provide a natural gas zone valve in a wall mounted box for each laboratory space requiring natural gas piping to bench top outlets. Include the UMB detail in the CD's. Coordinate the valve box location with the architect and electrical engineer.
3. The piping system material and isolation valves shall be as specified in the UMB master specifications.

D. **System Diagram:** Provide a complete diagram for the natural gas system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

21.8 Laboratory Specialty Gas Systems:

A. Laboratory specialty gas systems include compressed air, vacuum, co2, nitrogen, nitrous oxide, and oxygen systems and related piping distribution systems as required by the project program.

B. Laboratory compressed air and vacuum systems; shall be provided with multiple compressors and pumps for increased reliability, lead/lag starting controls, and arranged with complete isolation mechanically and electrically for servicing of one unit without interruption of operation of the other unit. Specify unit controller to sequence pumps and shall be interfaced with the BAS. Individual pumps without a master controller are not acceptable.

C. When directed by UMB or as required by the project program laboratory compressed air systems shall be designed to supply 120 psi compressed to laboratory spaces special equipment requiring air pressure between 85 and 120 psi. Provide pressure reducing valves in the system to serve laboratory areas where air pressure requirements are less than 85 psi. Design of separate compressed air systems may be considered and should be reviewed with UMB at the Design Development Phase.
D. All vacuum and compressed air systems and other specialized laboratory gas systems such as nitrogen, and nitrous oxide shall be designed to meet the requirements of NFPA 99, latest edition. System alarms shall be interfaced with the BAS along with a local alarm.
E. Where the project program or user requirements indicate the use of portable cylinders, the A/E shall design a manifold distribution system. The design shall include space and accessories for bottle holding racks, isolation valves, and refilling provisions. Coordinate with the A/E team for all design requirements.
F. Laboratory Specialty Gas Piping Systems:

    1. The piping system material and isolation valves shall be as specified in the UMB master specifications.
    2. Design laboratory specialty gas piping distribution systems for all laboratory spaces, fume hoods, biological safety cabinets, and countertop outlets as defined in the project program or as directed by UMB. For each distribution system include isolation valves for each laboratory space, floor level branch piping and at the base of each riser.

G. **System Diagrams:** Provide a complete diagram for each laboratory specialty gas system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

21.9 Reverse Osmosis/Deionized (RO/DI) Water Systems:

A. Provide either a central RO/DI water system or a point of use RO/DI water system to meet the needs of the project. Coordinate with UMB to determine the RO/DI loads for the project. Where existing RO/DI system is present with sufficient capacity for expansion, consider connecting to the existing system in lieu of designing a new RO/DI system.
B. When the project requires a central RO/DI water system (minimum one (1) meg Ohm quality water) this system shall be designed as a parallel recirculating type system complete with all necessary storage tanks, process equipment, piping controls, safety devices, etc. The system design shall also include provisions for both floor and individual laboratory isolation.
C. Coordinate all system components with UMB.
D. The central RO/DI system shall be located in a mechanical room on the penthouse level or the uppermost floor of the building. Make provisions for sanitizing sections of the system without affecting other parts of the building.
E. RO/DI Piping System:

    1. The piping system material and isolation valves shall be as specified in the UMB master specifications.
    2. Design an RO/DI pipe distribution system to all laboratory spaces, fume hoods, biological safety cabinets, and countertop outlets as defined in the project program

or as directed by UMB. Include isolation valves for each laboratory space, floor level branch piping and at the base of each riser.

3. **System Diagram:** Provide a complete diagram for the RO/DI system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

21.10 Laboratory Plumbing Design For New and/or Renovation Projects:

A. **Design Intent:** The intent of the laboratory plumbing design is to standardize the use of materials, equipment, and systems for all new laboratory installations and all laboratory renovation projects. The A/E shall discuss with UMB the selection of all material and equipment prior to proceeding with the design.

B. **General Laboratory Requirements:** Standard laboratory requirements shall include but not be limited to the following:

1. **Plumbing Services:** Plumbing services shall include acid waste and vent, cold hot and hot water return, natural gas, air, vacuum, RO/DI and bottled gas services for all laboratory fixtures and equipment.
2. **Plumbing Fixtures:** Plumbing fixtures shall include laboratory 18 gauge polished stainless steel 10-1/2 inches deep drop in type sinks with sound deadening undercoat, except sinks in epoxy tops shall be epoxy composition, either integral or dropped-in as directed. Outlets for water, gas, air, vacuum, and bottled gases shall be either deck mounted or wall mounted as directed by UMB.
3. **Emergency Eye Wash and Shower:** Include one (1) emergency hand held eye wash assembly, in each laboratory, located on the left side of a laboratory sink. Locate emergency showers so that the travel time from any laboratory does not exceed the travel time required by applicable codes or laboratory design standards. Emergency shower locations do not require floor drains, and they shall not be provided except as otherwise directed by UMB.
4. **RO/DI Faucets and Connections:** In each laboratory provide a non-recirculating gooseneck faucet with an integral vacuum breaker at each sink. Also provide a RO/DI valved connection for a local polishing unit adjacent to a sink.
5. **Natural Gas Service:** In laboratories requiring natural gas service for two (2) or more outlets provide a gas zone valve mounted in a recessed wall mounted zone valve box assembly located in the corridor adjacent the entrance to each laboratory.

C. **Special Laboratory Requirements:** Special laboratory requirements shall include but not be limited to the following:

1. **Low Flow Chemical Fume Hoods:** In laboratories with low flow chemical fume hoods provide plumbing services for laboratory gases and a cup sink.
2. **Biological Safety Level Cabinets:** In laboratories with biological safety cabinets provide a vacuum service to each hood.
3. **Tissue Culture Laboratories:** In tissue culture laboratories provide a dedicated bottled gas manifold piping distribution system to supply carbon dioxide for each incubator. The manifold shall be suitable for multiple cylinders.
4. **Biological Safety Level 2 (BSL-2) Laboratories:** In BSL-2 laboratories provide a hand sink, either stainless steel or porcelain, and an eyewash station located near the exit door. Vacuum lines should be protected with High Efficiency Particulate Air (HEPA) filters, or their equivalent. Filters must be replaced as needed. Liquid disinfectant traps may be required.

5. **Biological Safety Level 3 (BSL-3) Laboratories:** A/E design team must coordinate the designs for biological safety level 3 areas with UMB.
6. **Animal Biological Safety Level 3 (ABSL-3) Laboratories:** A/E design team must coordinate the designs for animal biological safety level 3 areas with UMB.
7. **Surgery Laboratories:** In laboratories used for survival and/or non - survival surgery in addition to standard laboratory requirements provide a stainless steel scrub sink with wrist blade handles on the faucet and wall mounted gas, air, and vacuum outlets.
8. **Animal Holding Rooms:** In rooms used to hold animals provide hose bibs and floor drains.
9. **Prosthetic Dental Laboratories:** In prosthetic dental laboratories provide special sinks with plaster and/or metal traps as directed.
10. **Dark Rooms:** In dark rooms provide dark room sinks and trays as directed by UMB.

21.11 Plumbing Fixtures:

A. Provide the quantity and type of plumbing fixtures that complies with the State Plumbing Code, ADA, and University requirements and/or meets the needs of the project being designed.
B. **Fixture Elevations:** Each trap for plumbing fixtures and floor drains shall be installed so that the trap invert is not less than three (3) feet above the top of the City sewer or main private sewer into which it discharges.
C. At or before the 50% CD submission, the engineer shall review with UMB the proposed specifications and selections for all plumbing fixtures to be included in the design.
D. Tank type water closets shall not be specified.
E. Push-button type metering faucets shall not be specified.
F. Plumbing fixtures used for people with disabilities shall meet the requirements of ADA for handicapped accessibility.
G. Where required by the University, provide automatic faucets for each lavatory and automatic flush valves on each water closet and urinal. The automatic faucets and flush valves shall be battery powered type. See UMB Specifications. This design shall be coordinated with UMB.

21.12 Drinking Water Dispensers:

A. **General:** Provide one (1) drinking water dispenser adjacent to or near multi-stall toilet rooms, but not in entrance lobbies, or where hazardous materials are stored.
B. **Type of Dispensers:** Drinking water dispensers shall be standard packaged self-contained refrigerated drinking water dispensers such as electric water coolers or combination water cooler and bottle filling stations. Coordinate dispenser type with UMB D&C.
C. **Drinking Water:** Drinking water shall be chilled and supplied at 55^0F from the drinking water dispensers.

End of Chapter

Chapter 22: Heating, Ventilating And Air Conditioning System Design

Amended 09-21-2022

22.1 Scope

A. This part outlines the minimum requirements for the design procedures for heating, ventilation, and air-conditioning (HVAC) systems, and energy conservation, for new buildings, and repair and alteration projects for existing buildings on the UMB campus. See UMB Master Specifications, Division 23 HVAC for more detailed information for material, equipment, and installation requirements.

22.2 Design Criteria:

A. General:

1. Comfort: Comfort conditions to be maintained are dry-bulb temperature and relative humidity, as measured at five (5) feet above the floor. The indoor temperature varies with the activity and intended use of the building. Review the design of wall, floor, roof, and glazing assemblies to ensure they are optimized for energy efficiency, comfort, and condensation control.
2. Wall and Roof Construction and Glazing: Wall and roof construction and glazing should provide inside surface temperatures not lower than those in the following table when minimum outside design temperatures and maximum wind velocities prevail. Limits for office space should be used for laboratory and for other spaces where sedentary work is done near outside walls and windows. Limits for shops may be used in all other cases.

    a. Minimum Inside Surface Temperature

Surface	Non-Shop Space	Shop Space
Glass	45°F	N/A
Walls	60°F	45°F
Ceiling/Exposed Roof	60°F	60°F

3. Slabs on Grade: Make recommendations to UMB and the A/E team following the ASHRAE Handbook of Fundamentals for insulation of concrete slabs on grade.
4. Elevated slabs above grade: Submit recommendations to UMB.

B. Design Conditions and Calculations:

1. Indoor / Outdoor Design Conditions: Base indoor / outdoor design conditions for heating and cooling as indicated in the table below:
2. Building Load Calculations – Indoor/Outdoor Design Conditions

Table 1 Building Load Calculations – Indoor/Outdoor Design Conditions

Space	Indoor Summer °F db/wb	Indoor Winter °F db	Indoor RH Summer %RH	Indoor RH Winter %RH	Outdoor Summer °F db/wb	Outdoor Winter °F db
Offices, Conference Rooms, Laboratories, Classrooms, Public Areas	75 / 62.5	72	50	0	95 / 78	0
Vestibules and Stair Wells	72 / 60	65	50***	0	95 / 78	0
Vivarium's, Animal Rooms, Isolation Rooms, Surgical Rooms, Bedding and Feed Storage, Support Areas, etc.	75 / 62.5	72	50	30 - 50	95 / 78	0
IT (Server Rooms) / Computer Rooms *	72 / 60 *	50**	50	__	95 / 78	__
Mechanical Equipment Rooms, Electrical Substation Rooms *	80 / 66 *	50**	50	__	95 / 78	0
Penthouse MER *	80 / 66 *	60	50	0	95 / 78	0
Elevator Equipment / Machine Rooms *	78 / 65 *	50**	50	__	95 / 78	__

* Cooling only year around. Indoor design temperatures based on requirements for electronic components such as DDC controllers VFD's, sensors and equipment loads.

** Heating may not be required, but if heat is required, then use this temperature.

*** Heating may not be required, but if heat is required, then use this temperature.

3. Individual User Requirements: Where individual user requirements exceed the limits in the table, appropriate systems shall be provided for localized environmental control. These systems shall be separate and independent from the general building systems. However, it is the intent of the University to provide the majority of the HVAC needs with central building systems. Use of small, localized systems is discouraged, and should only be used for special circumstances, and will be subject to UMB review and approval.
4. Load Calculations and Energy Analysis: Calculations and analysis shall be based upon established ASHRAE procedures and shall be presented using commercially available standard software. For all renovation projects the engineer shall survey the existing areas to determine the impact on the cooling load from internal heat gain from neighboring spaces and all existing equipment.

22.3 Ventilation Requirements:

A. Ventilation Rates: Ventilation rates shall be established initially in accordance with ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quantity, latest edition or latest edition and applicable NIH Guidelines or LEED requirements, whichever is more stringent for the anticipated occupancies.
B. Since operating experience shows that many UMB Facilities undergo significant changes in occupancy during the life of the building, it is expected that the design ventilation rates will be reviewed and possibly modified by UMB prior to incorporation into the system design.
C. Indoor Air Quality Analysis: The A/E shall perform an indoor air quality analysis to address the following:

1. Identify interior and exterior contaminants.
2. Provide containment or dilution control for all toxic, flammable and corrosive fumes.
3. Review material safety data sheet (MSDS) information for all chemicals and materials to be used in the facility during construction and when occupied.
4. Eliminate all potential for standing water in the air handling and mechanical systems and equipment.
5. Identify all volatile organic compounds (VAC) emitted by existing and proposed building finishes and furnishings.
6. Establish area to area pressurization requirements where appropriate and be consistent with requirements in 22.11 and 22.17 in this Chapter.
7. Eliminate potential for microbial growth in HVAC systems and control humidity to prevent growth of mold on surfaces.
8. Determine the level of particulate filtration at louvers and in AHUs as required to minimize the potential for particulate contamination, such as dust, insects, pollen, dander, and spores.
9. Evaluate the need for monitoring the levels of carbon monoxide and other harmful gases.

22.4 Building Distribution Systems:

A. General: Campus building distribution systems include chilled water systems, process cooling water systems, condenser water systems, heating water systems, energy recovery systems, and steam systems. All building distribution systems shall be piped as reverse return unless otherwise directed by UMB.

1. Each piping system material and isolation valves shall be as specified in the UMB master specifications.
2. For each distribution system include, at a minimum the design shall include isolation valves at each equipment connection, floor level branch piping and at the base of each riser.

B. System Operation and Monitoring: Campus building systems are operated and monitored by campus energy managers using two (2) campus-wide automated energy monitoring and control systems. The HVAC system sizing and selection process shall be influenced by operating preferences and campus-wide standardization of systems where possible. In general, chilled water plants are not operated during the heating season. However, the typical system design includes connections to a campus wide chilled water loop, which requires the building chilled water circulation system to be operational at all times. It is generally preferred that system designs take full advantage of all available free cooling, economizer options.
C. Unoccupied Hours: During unoccupied hours, energy shall not be added to increase space temperature to 55^0F unless specific program requirements state otherwise. Since this will require heating the building mass on the next occupied cycle to at least above minimum inside surface temperature; make provisions to increase system capacity to provide this capability within two (2) to three (3) hours.

22.5 Cooling Systems – Chilled Water And Condenser Water:

A. General: Maintain required indoor design condition in spaces by supplying cooling adequate to offset the heat gain. In general, cooling energy shall be provided from cooling plants located in buildings on the UMB campus. The cooling plants include chilled water, and condenser water distribution systems located in various campus buildings. The campus also has chilled water distribution loops between various buildings to optimize chiller plant operation. These plants supply chilled water to air distribution systems and supplemental cooling systems located in the buildings.
B. Water Treatment Systems: Provide water treatment systems for chilled water and condenser water systems.
C. Chilled Water Systems – New Construction: Specify that the water treatment for the chilled water systems shall be provided by the water treatment company under contract with UMB for new buildings connecting to the campus chilled water loops.
D. Condenser Water System – New Construction: Specify that the water treatment for the condenser water system shall be provided by the water treatment company used for the heating systems.
E. Chilled Water & Condenser Water Systems – Renovation Projects: Specify that the water treatment for the chilled water & condenser water systems shall be provided by the water treatment company under contract with UMB.
F. Cooling System ATC Valves and Energy/Flow Meters: All ATC valves and energy/flow meters in the cooling systems shall be provided by ATC and monitored by the BAS. All energy/flow meters monitored by the BAS shall be specified to be BAC Net IP compatible.
G. Campus Chilled Water Systems: The campus chilled water system is comprised of three (3) campus chilled water distribution loops as follows:

    1. North Loop: Located in the vicinity of Baltimore and Pine Streets, the north loop interconnects the chilled water plants in the seven (7) largest campus buildings along Baltimore Street: Bressler Research Building, Health Sciences Facilities 1, Medical School Teaching Facility, Pharmacy Hall, Pharmacy Addition, Health Science Facilities 3 and The Dental School. The chilled water loop also serves Health Science Facilities 2, and Howard Hall buildings which do not have chilled

water plants. UMB has projects under construction to extend the north loop to the IHV Building and the 108 North Greene Street Building.

2. South Loop: Located in Lemmon Alley between S. Greene and Pine Streets, the south loop interconnects chilled water plants in the Health Sciences/Human Services Library, School of Nursing, and the Campus Center. UMB is considering extending the south loop to the General Research Building. Some infrastructure in GRB has already been installed.
3. East Loop: The east loop interconnects chilled water plants in the School of Social Work, Davidge Hall, Gray Lab, and the Museum of Dentistry.
4. System Fill Pressures: Because the chilled water systems in numerous buildings are interconnected, particular attention must be paid to fill pressures and the specification of pipe, fittings, coils, valves, and all other accessories in the chilled water system under design. The maximum fill pressure of the system will be determined by the height of the tallest building connected to the loop. In the case of the north loop that is Bressler Research Building. For all chilled water systems connected to the north loop, 250 lb. fittings are required.

H. Building Chilled Water Distribution Systems: Chilled water systems shall be designed as primary/secondary distribution systems configured with primary/secondary bridge connections, loop valves with bypasses, and DPS sensors across each bridge similar to chilled water system in HSF-3.

1. Building Primary Chilled Water Distribution Systems: Building primary chilled water distribution system shall be designed to provide 45^0F chilled water to the buildings secondary chilled water and process cooling water systems and to/from the campus chilled water loop system with a 12^0F temperature rise through the cooling coils. This system shall include primary (lead/lag arrangement) pumps with VFD's sized for importing and exporting chilled water to or from the campus chiller water loop, as well as maintaining the required flow rate in the primary system to each chiller. Design primary pump head loss should be seventy five (75) ft. Provide one (1) primary pump for each chiller, sized for the design flow rate through the chiller. Provide a standby pump with a VFD as well.
2. Building Secondary Chilled Water Distribution Systems: Building secondary chilled water distribution system shall be designed to provide 45^0F chilled water to AHU and sensible cooling (FCU) units with a 12^0F temperature rise through the cooling coils. This system shall include two (2) secondary pumps (lead/lag arrangement) and a VFD for each pump. Design differential pressure shall be coordinated with UMB.
3. Building Secondary Process Cooling Water Distribution System: Building secondary process cooling water distribution system shall be designed to provide cooling water to serve water cooled compressorized equipment for environmental cold rooms, lasers, electron microscopes, and water cooled dx A/C units serving computer/server rooms. This system shall include two (2) secondary pumps (lead/lag arrangement) and a VFD for each pump. The pumps shall be served with emergency power. Design differential pressure shall be coordinated with UMB.
4. Existing Building Secondary Process Cooling Water Distribution Systems: Existing secondary process cooling water distribution systems are located in the campus buildings indicated in the table below:

a. System Design Data: When new connections to the existing systems are required comply with the system design data in the table below. Verify existing operating conditions for the project site and the point of connection to the system.
b. New Equipment Connections: Verify that the equipment to be connected to the existing system is compatible with the available temperature and pressure.
c. Connections to the Existing Systems: For systems in locations one (1) through nine (9) in the table below, the system operation pressures could be as high as 150 psi between the lowest system connection point to and the middle elevation connection point in the building. All equipment and/or materials such as hoses that are connected to the systems between the low level and middle levels must be rated for the higher system operation pressure.

5. Existing Building Secondary Process Cooling Water Distribution Systems Design Data

Table 2 Existing Building Secondary Process Cooling Water Distribution Systems Design Data

System Tag	North Chilled Water Loop System Building Locations	Available System Pressure Differential**	EWT °F	LWT °F
1	Bressler Research Building	14 psi /32.3 ft	70	90
2	Howard Hall	18 psi /41.5 ft	62	82
3	Medical School Teaching Facility	8 psi /18.4 ft	70	90
4 N	Dental School - North	18 psi /41.5 ft	70	90
4 S	Dental School - South	16 psi /36.9 ft	70	90
5	Health Sciences Facility I	21 psi /48.4 ft	70	90
6 A	Health Sciences Facilities II - A	23 psi /53 ft	70	90
6 B	Health Sciences Facilities II - B	15 psi /34.6 ft	70	90
7	Health Sciences Facilities III	9 psi /20.7 ft	70	90
8	Pharmacy Hall	20 psi /46.1 ft	70	90
9	Pharmacy Addition	30 psi /69.2 ft	70	90
10	Allied Health (Design Data not Available)	n/a	n/a	n/a
11	MBI (IHV)	30 psi /69.2 ft	58	78

* Available System Pressure Differential represents the operational set point for each system and is intended to be used by the design engineer when expanding the existing system.
**The listed psi differential is a steady state condition 24/7.

a. Make adjustments as needed between the location where the setpoint is maintained and the location where equipment is connected to the system in the project.
b. Where design data is not available, Engineer to coordinate with UMB to visit the site and record missing data.

I. System Design: Condenser water systems serving cooling towers and chillers shall be designed for a supply temperature of 85^0F with a 10^0F temperature rise through the chillers and a 10^0F drop through the cooling towers. These systems shall include one pump per chiller, sized for the design flow rate through the chiller, a standby pump, VFD's, controls, condenser water filter/backwash system, and an automatic drain and fill system. Coordinate with UMB for condenser water piping material specifications. UMB requires FRP piping for exterior portions of the condenser water piping system to minimize corrosion and scale build up when systems are drained down.

J. Automatic Drain and Fill System: The automatic drain and fill system shall be designed to drain the system to a level of two (2) feet below the roof when the ambient outdoor temperature is 35^0F or below. When the ambient air temperature rises to a pre-programmed temperature range of 55^0F to 65^0F the BAS shall fill the system automatically. The design and specifications for this system shall be coordinated with UMB.

K. Tower Bypass: The condenser water distribution system design shall include appropriately sized tower bypass piping. The bypass piping shall be located inside the conditioned building, and as close as possible to the cooling tower. The design and specifications for this system shall be coordinated with UMB.

L. System Water Metering: Cooling tower make-up water shall be an automatic fill system with reportable water meters on the tower make up water (tower fill), and tower bleed lines. The meters for the tower fill and bleed systems shall be as approved by Baltimore City. The design and specifications for this system shall be coordinated with UMB and as follows:

    1. Inline Type Meters: See UMB Mechanical Specifications and Detail # 50 for requirements.
    2. Strap on Type Meters: See UMB Mechanical Specifications and Detail # 53 for requirements.

M. Cooling Tower Rebate System: Provide a cooling tower rebate system including reportable meters, for makeup/fill water, tower bleed, tower overflow, and tower drain, to send recorded data to the BAS through a Bac Net IP or Modbus interface system. The design and specifications for this system shall be coordinated with UMB.

N. Cooling Tower Filter/Backwash System: The condenser water system shall be provided with a cooling tower filter/backwash system located in a mechanical room near the cooling tower(s). This system shall include a filter system for the tower condenser water, a domestic water service connection for flushing the filter media and all necessary water and drain piping, valves, controls, equipment, electrical service etc. The design and specifications for this system shall be coordinated with UMB. Include in the design narrative the type of system and sizing parameters.

O. System ATC Valves and Energy/Flow Meters: Specify that all ATC valves and/or energy/flow meters in the condenser water systems indicated above shall be provided by ATC and monitored by the BAS.

P. Exterior Condenser Water Pipe Material: UMB is currently utilizing FRP piping for exterior portions of the condenser water piping system to minimize corrosion and scale build up. All exterior pipe material for condenser water, drain, equalizing and overflow piping shall be FRP pipe and fittings to a point two feet below the roof level of the building. See UMB Specifications for additional requirements.

Q. Cooling Tower Piping: Cooling tower piping shall include separate headers for condenser water supply, condenser water return, equalizing line, tower drain, and tower overflow and appropriate branch piping for each service to each tower cell. UMB requires condenser water return piping to the tower cells to be installed to the exterior to each tower cell. Provide supports for the vertical piping and flexible connections on each service pipe to allow for movement of the tower on their isolation rails free of the piping. See UMB Specifications and Details for additional requirements. If more than one (1) tower cell will operate simultaneously, ensure the header size for multiple tower connections is larger than the branch sizes.

R. Building Sensible Cooling Systems: In laboratory areas where the calculated room sensible heat gain requires a supply/exhaust air volume that exceeds six (6) air changes per hour (ACPH) of 100% outdoor air, provide the air volume equal to the six (6) ACPH from the building air system. The balance of the room sensible heat gain shall be offset utilizing one and/or a combination of the following systems for both new and renovation projects:

1. Fan Coil Units: Fan coil units including a fan, cooling coil, and filter enclosed in a metal housing and supplied with chilled water from a secondary chilled water system that provides chilled water at 45^0F, with a 12^0F temperature rise year-round. Depending on available space in the laboratory these units can either be floor or wall mounted or located above the ceiling of the laboratory. Units located above the ceiling shall be specified with duct collars and must be located so the units can be accessed for service. Floor or wall mounted units shall be specified with supply and return grilles in the casing.
2. Chilled Beams: When space is available include in the design the required number of chilled beams arranged along the ceiling and supplied with chilled water from a secondary chilled water system that provides chilled water of not less than 60^0F, with a 12^0F temperature rise year-round. Include the required controls to maintain a supply water temperature without condensation and an automatic shut off of water flow if the space dew point temperature could produce condensation.
3. Compressorized Cooling Units: In buildings where chilled water is not available provide a dry cooler system and pump package to provide water/glycol (40%) mixture to compressorized cooling units serving computer / server rooms or serving as sensible cooling units in occupied spaces. Depending on available space in the laboratory these units can either be floor mounted or located above the ceiling. Single or multiple units located above the ceiling can either fit within a ceiling grid or be configured for supply and return ductwork. Units located above the ceiling shall be specified with duct collars and must be located so the units can be accessed for service. Floor mounted units shall be specified with supply and return grilles in the casing. Due to noise considerations UMB prefers units configured for duct work in occupied spaces. These units shall be cooling only units.

22.6 Mechanical Cooling:

A. Compressorized Equipment: Selection of the type of refrigeration systems shall be coordinated with UMB. Selection criteria shall address:

1. Peak load performance.
2. Part load performance.
3. Unloading capability to 20% of capacity.

4. Multiple units for redundancy.
5. Compliance of refrigerants with current environmental requirements.
6. Compatibility with campus-wide energy management and control system.
7. Acceptable noise level (indoor and outdoor).
8. Special systems such as hot gas bypass, low ambient controls, etc.
9. Reliability.

B. Packaged Roof Top Equipment: Where packaged roof top equipment is used, such as air cooled chillers or self-contained roof top air handling units, specify high efficiency performance.

C. Heat Rejection Equipment Selection:

1. Cooling Towers:

   a. Cooling tower selection shall be based on performance rating at 80^0F wet bulb. Multiple units shall be provided for redundancy where appropriate. Noise criteria shall be determined and shall influence selection. Potential for winter operation shall be coordinated with UMB. Special consideration shall be given to the plume characteristics of the unit discharge with respect to helicopter approach and exit paths from the MIEMMS helipad. Coordinate with the A/E team for any screening requirements and provide adequate clearance for air flow and service. When VFD's are considered for cooling towers specify a direct drive fan assembly or a gear drive fan assembly. Coordinate with UMB.
   b. All other heat rejection equipment shall be selected for an outside air temperature of 100^0F dry bulb when located on grade and an outside air temperature of 110^0F dry bulb when located on a roof level.

D. Cooling Tower Service Platforms, Hand Rails and Stairs:

1. General: Where cooling towers are elevated above the finished grade or finished roof level by three (3) feet or more the project design shall include service platforms, safety rails, toe kicks, access stairs with hand rails. The service platforms shall be located around the entire perimeter of the tower(s) to access the fill basin from the exterior of the tower for maintenance and to access the doors at the ends of each tower. All components shall be constructed of galvanized steel with bolted and/or welded joints. All walking surfaces shall be open grate non slip type surfaces. The Engineer shall coordinate the requirements for the service platforms and all accessories with the Architect and Structural Engineer for inclusion with the support system for the cooling towers.
2. Service Platforms: Service platforms shall be level with the bottom of the cold water basin and shall extend outward thirty six (36) inches from each side of the cooling tower with forty two (42) inch high hand rails and two (2) inch high toe kicks around the perimeter of the platform. The load bearing capacity of the assembly shall be not less than 300 lbs. /sq. ft. These service platforms shall be connected to the steel support dunnage for the cooling towers. Do not support these platforms off of the base rails for the cooling tower. Leave clearance to allow for the free movement of the cooling tower on their isolation rails.
3. Access Stairs: Access from the finished grade or roof level to the service platforms shall be provided by a thirty six (36) inch wide stair with thirty six (36) inch high handrails. Do not use ships ladders.

22.7 Heating Systems – Water And Glycol:

A. General: Maintain required indoor design condition in spaces by supplying heat adequate to offset heat loss. In general, heating energy shall be provided from the district steam system serving the UMB campus. The engineer shall contact UMB to determine the process for design of the steam service and first stage of pressure reduction for the building. In general, the steam service and metering shall be as directed by the district steam provider. Where not economically feasible, other sources shall be investigated. Where gas is used, gas-fired heating systems shall have output-to-input energy efficiency ratings of not less than that recommended in ASHRAE 90.1. Systems may be combined with ventilating and air-conditioning if functionally and economically feasible. Selection of heating source shall be subject to review and approval by UMB.

B. Water Treatment Systems: Provide water treatment system for the heating hot water systems.

1. Heating Hot Water System – New Construction: Specify that the water treatment for the heating hot water system shall be provided by the water treatment company used for the condenser water systems.
2. Heating Hot Water System – Renovation Projects: Specify that the water treatment for the heating hot water system shall be provided by the water treatment company under contract with UMB.

C. System ATC Valves: All automatic ATC valves and energy/flow meters in the heating hot water systems shall be provided by ATC and monitored by the BAS. All energy/flow meters monitored by the BAS shall be specified to be BAC NET IP compatible.

D. Building Heating Water Distribution Systems: Heating hot water systems shall be designed as primary/secondary distribution systems configured with primary/secondary bridge connections with loop valves with bypasses similar to the heating hot water system in HSF-3.

1. Building Primary Heating Hot Water Distribution System: Primary heating hot water systems shall include a set of primary water pumps arranged for lead/lag operation with VFD's for each pump and temperature reset controls.
2. Building Secondary Heating Hot Water Distribution System: Each secondary heating hot water system shall include a set of secondary water pumps arranged for lead/lag operation with VFD's for each pump and temperature reset controls.
3. Building Secondary Heating Systems: Building secondary heating systems shall include the systems indicated below. Where appropriate, a combination of perimeter heating zones may be permitted, subject to UMB review and approval.

    a. Building Reheat System: Building reheat system, includes terminal reheat units and terminal heating units such as unit heaters, convectors, fan coil units, and fan powered terminals.
    b. Building Perimeter Heat Systems: Perimeter heating systems shall be zoned by exposure unless otherwise directed by UMB.

4. Heating System Relief Valves: Relief valves in heating systems shall be piped to the system make up water treatment tank, floor drains or other storage vessel unless directed otherwise by UMB. Relief valves in pre-heat glycol systems shall only be

piped to the systems glycol feeder or other storage vessel unless directed otherwise by UMB.

E. Perimeter Heating System:

1. Since control between interior and exterior spaces may cause a lack of comfort as seasons change, provide a perimeter heating system for the building glazing load only. Provide individual zones of control based upon building exposures and building component thermal characteristics. The design shall provide perimeter heat below every window or glazing element, ten (10) sq. ft. and larger, used in the perimeter building envelope, and shall consist of finned tube radiation. Hot water radiant heating panels shall not be used.
2. No space temperature controllers shall be used with the perimeter heating system. The perimeter heating media temperature shall be controlled with a temperature reset schedule, based on outside air temperature, controlled separately for each exposure.

F. Terminal Reheat and Duct Heating: For systems of appreciable size, as coordinated with UMB, a separate heating distribution system shall be provided for reheat and duct coils.

G. Air Handling Unit Heating, Unit Heaters and Convectors: Where there is no air handling unit heating coil, unit heaters and convectors may be combined with another zone as coordinated with UMB.

H. Preheat/Energy Recovery Systems: Each system shall be provided with a 40% ethylene glycol/water solution, using Dowtherm SR-1. Glycol is considered a hazardous material. System(s) shall be designed with a main recovery point for each system. Drain down points for glycol systems shall not be piped to any storm or sanitary drains in the building or on the roof. A central drain down point shall be designed so that glycol can be recovered in appropriate containers.

I. Redundant Heating Source and Distribution: Redundancy of the heating source shall be provided in the form of multiple, primary heating equipment. Primary heating equipment shall be sized for at least 2/3 of the peak load unless otherwise indicated or directed by UMB. The following primary heating sources shall be considered, subject to UMB review and approval:

1. Boilers: Where hot water boilers are selected as the primary heating source, provide two boilers, each sized for 2/3 of the peak load. Boilers shall utilize either gas, electric, or fuel oil as the source of thermal energy.
2. Converters: Where steam-to-hot water converters are used, provide 1/3 - 2/3 control valve arrangements. Each heating water system shall be provided with two converters, each sized for approximately 2/3 of the total anticipated load to provide for redundancy and future expansion.
3. District Steam Distribution System: When using steam from the district steam distribution system, steam is provided at high pressure, with the first stage of pressure reduction provided by the utility. Coordinate space and location requirements with the local utility. Provide an estimated steam demand load to the local utility and coordinate service sizes, capacities, and design requirements. The steam distribution system serving converters, coils and equipment shall be a medium pressure supply and condensate return system with an operating pressure of approximately 60 psi. Steam condensate from the high pressure and medium

pressure piping, reducing stations and distribution systems shall be routed through a flash tank vented to atmosphere. Steam condensate is not returned to the district steam system. When steam condensate is not considered for heat recovery the condensate shall be cooled to the maximum temperature permitted by Plumbing Codes prior to discharge into the storm water system.

4. Heat Recovery Methods: Heat recovery methods, such as for as recovering waste heat from steam condensate, shall be considered for domestic water preheat and for reheat systems preheat.

J. Floors Exposed to the Outside: Where occupied areas have floors exposed to the outside temperatures, provide unit heaters or other methods of maintaining a reasonable temperature in the space below the floor. Coordinate with the A/E team to appropriately insulate this space.

K. Entrance Heating: Heat entrance vestibules by cabinet unit heaters, located at floor level. Provide areas adjacent to frequently-opened doors with adequate heating equipment to overcome excessive heat loss when doors are opened in cold weather. Areas near exterior doors intended for occasional use shall be designed with heating equipment sized only to offset normal heat transmission, infiltration, etc.

22.8 Humidification Systems:

A. During late fall, winter and early spring, when buildings typically require heat to maintain comfortable interior environmental conditions, the outdoor environment experiences a significant drop in humidity levels. This is due to the inherent inability of cold air to hold much moisture. Because of the lack of sufficient vapor barriers in modern building construction, this low humidity outside will translate into low humidity levels inside buildings as well. With very few exceptions, low humidity will not cause health or other problems for building occupants. The only real requirement for humidity levels to be artificially controlled is in animal areas where fluctuations in humidity levels may negatively impact ongoing experimentation and research. Providing a humidification system in the mechanical equipment is a very costly process. The required humidification equipment and additional piping adds to the first cost of the system. The added expense of constructing a building or specific rooms in the building with the continuous vapor barrier necessary to overcome the resulting differential vapor pressure caused by the humidification process is significant. Coordinate with architect to ensure wood finishes are compatible with the expected humidity levels.

B. The continuous addition of moisture to the supply air system required to maintain an elevated humidity level increases annual energy costs. Continuous addition of moisture to air distribution system can cause mold growth in the ductwork, creating a problematic, unhealthy environment. The maintenance burden imposed by the humidification equipment is significant. Generation of steam, by its very nature; leaves behind deposits of minerals and other impurities which coat the humidification apparatus, rendering it useless and unserviceable within a relatively short period of time. For these reasons, it is the policy of the Design and Construction Department at UMB to forego the provision of humidification systems in the buildings' main air handling systems, and instead provide local humidification systems in areas where humidity control is critical to the occupants' function, such as in historical archive, display and storage rooms, and other special use areas. Where localized humidification systems are used all metallic components shall be specified to be constructed of stainless steel.
C. In buildings where the heating source is supplied from a connection to the local district steam utility, the central steam may not be of sufficient quality to be utilized directly for those special circumstances where local humidification is required. Local humidification should be provided by electric/steam humidifiers or clean steam generator depending on the requirements of the project. Coordinate with UMB for requirements.

22.9 Piping Systems:

A. Arrangement: Design of the heating, chilled and condenser water piping systems shall incorporate the pressure rating requirements of coils, piping, valves, and fittings where the combination of system fill pressure, determined by vertical height, and pump discharge pressure exceed the standard ratings. Take special note that it is common for system pressures to be high on the lower floors of some buildings, such as BRB. Field verify the existing system pressures when designing a connection to an existing system, including the chilled water loop.
B. Water Systems: Heating, chilled water, and all other hydronic systems shall be designed with a reverse return distribution system. Dual-temperature piping systems shall not be considered.
C. Hydronic Pipe Sizes: Base hydronic pipe sizes using a friction rate loss between one (1.0) and four (4.0) feet per one hundred (100) feet of straight pipe and resulting fluid velocity of not greater than fifteen (15) feet per second. The referenced friction loss and velocity rates are based on the design range indicated on B&G System Syzer Wheel and/or related B&G software app.
D. Hydronic Piping Layouts: The hydronic chilled water and heating water piping layouts shall be logically designed to provide organized distribution systems which permit the isolation of distinct sections without disruption to the entire building. This includes the following:

1. Isolation Valves: Isolation valves shall be provided at every major riser, floor branch and at all unit/equipment connections.
2. Manual Air Vents: Manual air vents shall be provided and shown on drawings at all high points of piping systems.

3. Hose End Drains: Hose-end drain valves shall be provided at the base of all risers, low points of piping systems, including all trapped sections of piping and at coils and equipment.
4. Future Connections: Provide valved and capped connections per floor in the hydronic distribution systems for future expansion. Coordinate with UMB for number, size, and locations of future connections.

E. Hydronic Piping Layouts - Self Contained Water Cooled Dx Equipment that is not served by a Dry Cooler: For heat rejection from self-contained, compressorized water-cooled equipment provide one (1) of the pipe connections, to meet the project requirements, as follows:

1. In buildings with a process cooling water system connect the dx equipment to the process cooling water system complying with the temperature and differential pressure table in the design data indicated in paragraph 4.5 in this section.
2. In buildings without a process cooling water system provide connections to the chilled water piping serving the AHU's. Provide hose-end drain valves on supply and return piping for emergency hook-up of domestic water. Obtain from UMB the latest schematic diagram for cooling water hookup for cold box units and other water cooled compressorized equipment. Coordinate with Design & Construction Department for additional requirements or alternate design considerations.
3. In buildings without chilled water or process cooling water systems provide connections to the buildings domestic water system for supply water and a drain to the storm water system. Coordinate with Design & Construction Department for additional requirements or alternate design considerations.

F. Steam and Condensate Pipe Sizing: Base pipe sizing on approved engineering practices. UMB recommends the following design considerations:

1. Steam Pipe Sizes: Base steam pipe sizes using a friction rate loss between one half (1/2) psi and two (2.0) psi per one hundred (100) feet of straight pipe and resulting fluid velocity of not greater than eight thousand (8,000) feet per minute at the operating pressure (60 psi) for Schedule 40 Pipe.
2. Steam Condensate Pipe Sizes: Follow the sizing requirements for steam pipe above.

G. Steam and Condensate Pipe Layouts: The steam and condensate piping layouts shall be logically designed to provide organized distribution of steam supply and condensate return to/from the equipment requiring these services.

1. System Operating Pressure: UMB requires 60 psi team to serve equipment such as heat exchangers, autoclaves, glass washers and sterilizers.
2. Slope Piping: System design shall include allowances for the steam and condensate piping to be sloped @ one quarter (1/4) inch in ten (10) feet in the direction of the steam and condensate flows with dry steam supplied to the connected equipment.
3. Gravity Drain Piping: Condensate piping from the equipment should be gravity drained to the buildings condensate energy recovery/cooling system before the condensate is discharged to a drainage system.
4. Pipe Elevation Changes: Where steam piping changes elevation in the direction of flow include steam traps to control and remove condensate from the steam supply.

5. Shut Off Valves and Accessories: Include shut off valves, steam control valves, check vales and traps where required.

H. Piping Expansion: Show locations of expansion compensators, loops, and anchors on drawings. Incorporate flexible connections and acoustical treatment to prevent transmission of vibration and fluid noise. Due to maintenance problems with compensators, expansion loops shall be used wherever possible.

I. Flow Measurement: Provide suitable devices so flow (GPM) can be measured in major branches and major equipment such as chillers, cooling towers, boilers, coils, convertors, and primary and secondary loops. Where required by UMB the measured data shall be transmitted to the building automation system and/or other existing data collection system. Provide balancing devices to allow adjustment. The piping layouts shall incorporate manufacturer's installation requirements of flow measuring devices to ensure accurate readings. This includes the provision of the necessary straight runs of piping required upstream and downstream in the piping system for proper operation. See UMB Master Specifications and Details for additional requirements.

J. Energy and Flow Measurement: Provide suitable devices so energy (BTU) and flow (GPM) can be measured in major branches and major equipment such as chillers, cooling towers, and primary and secondary loops. The measured data shall be transmitted to the building automation system and/or other existing data collection systems. The piping layouts shall incorporate the manufacturer's installation requirements of flow measuring devices to ensure accurate readings. This includes the provision of the necessary straight runs of piping required upstream and downstream in the piping system for proper operation. Energy meters that are reportable to BAS shall be BAC Net IP based meters.

K. Expansion and Air Elimination: Provide an expansion tank and air separator for each closed system. The design of the connection to the expansion tank shall include a lockable isolation valve and a drain valve between the isolation valve and the tank to permit reducing system pressure on tank during draining and recharging operations. Specify tanks with field charging and drain connections.

L. Makeup Water Connections: Provide each hydronic piping system with a makeup water connection for filling purposes that complies with local codes, with a reduced pressure backflow preventer. Design shall include determination of fill and relief valve pressures. Provide pressure and temperature relief valves for both heating and cooling systems. The pressure rating of all make-up piping, valves and fittings shall be specified to exceed the system operating pressure by at least 20%. On all glycol systems, design a manual make-up water feed to a mix tank with a pump fill system. Do not provide an automatic make up water system directly piped to the distribution piping on glycol systems. The relief valve on glycol systems shall be piped to discharge into the mix tank.

M. Water Treatment: Provide, in each closed-loop water piping system, three quarter (3/4) inch valved connections for the chemical treatment systems. Coordinate system requirements with UMB. Obtain water treatment chemical requirements from UMB.

N. Variable Speed Pumping: Design variable speed distribution on systems with seven and one half (7-1/2) HP pumps and larger, or where economically justified, for all heating and cooling systems. Specify 2-way ATC valves for load modulation where variable speed distribution is used. Specify a dedicated VFD for each pump. Provide modulating 2-way minimum flow control valve where needed to protect distribution pumps, chillers, etc. In general, do not use 3-way valves to limit minimum flow.

O. Materials: The UMB master specifications permit the use of rolled grooved pipe and fittings, such as victaulic. The use of grooved pipe fittings is preferred in areas such as mechanical rooms, where the potential for future modifications exists. However, grooved pipe fittings are not an acceptable substitute for flexible connections or for expansion compensation.

P. System Diagrams: Provide complete diagrams for each HVAC piping system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

22.10 Air Handling Systems:

A. General

1. Air handling systems shall maintain the interior space conditions required for the building by simultaneously controlling the supply air temperature, humidity, and air volume to the space. The following systems shall be considered for use:

    a. Modular air handling units.
    b. Built-up air handling systems.
    c. Constant air volume. (CV)
    d. Constant volume (CV) with reheat.
    e. Variable air volume (VAV)
    f. Variable air volume (VAV) with reheat.
    g. Four (4) pipe fan coil.
    h. Self-contained water cooled DX units.
    i. Self-contained, split system direct expansion units. (limited to special applications).

2. The mechanical engineer shall identify the proposed air distribution system design to UMB at the Design Development Phase for review.
3. Constant Volume Reheat Systems: Where constant volume reheat systems are used, provide one terminal reheat unit for no more than four hundred (400) square feet of space, but more terminal reheat units may be necessary to meet control requirements contained elsewhere in these standards.
4. Capacity Control:

    a. Provide inlet vane control and/or variable pitch blade control or VFD's for fan capacity control.
    b. Where variable air volume (VAV) systems are designed, select the units based on the calculated block load of the area served. Air quantities shall be calculated on total connected peak loads similar to constant volume system design.

B. Future Expansion: Future expansion capability shall be incorporated into the air handling unit selections. The degree of expansion shall be coordinated with UMB.

C. Laboratory Spaces: Where the HVAC system will serve laboratory spaces, a 100% outside air, constant volume or VAV terminal reheat system shall be designed with a dedicated supply terminal reheat unit and general exhaust terminal unit and/or fume hood exhaust terminal unit for each space for each space.
D. Animal Room Ventilation: The A/E team shall consider the use of cage ventilation systems for animal room ventilation where appropriate. If required by the UMB, the A/E team shall conduct a life cycle cost analysis of the cage ventilation system and compare it to a more traditional ventilation design approach.
E. Location of Outside Air Intakes:

1. It is generally desirable to locate outside air intakes at the roof level. Where this is not economically feasible, outside air intakes shall be located not less than ten (10) feet above the surrounding grade, and never in an areaway or below grade well.
2. The design shall maintain a minimum separation of fifty (50) feet between outside air intakes and relief or exhaust air discharge, and the outside air intake shall always be located on the windward side, as determined by local prevailing wind direction.
3. Outside air intakes shall not be located where exhaust from vehicles at loading docks, parking spaces, dumpsters, emergency generator exhaust or other idling motors can enter.

F. Energy Efficient Systems: All air handling systems with recirculating air shall be designed with 100% outside air economizer, unless otherwise directed by UMB. The design shall include a powered exhaust for 100% relief air.
G. Louvers:

1. Coordinate the location, selection and specification of all intake and exhaust louvers with the A/E team. If specified by the architect, provide appropriate performance and construction data for inclusion in the specification.
2. Size intake louvers for a free area face velocity not to exceed five hundred (500) FPM with zero moisture penetration.
3. Size exhaust louvers for a free area face velocity not to exceed eight hundred (800) FPM.
4. All louvers shall be specified to be storm proof.
5. Specify that one half (1/2) inch wire mesh shall be provided on all louvers.

22.11 Air Distribution Systems:

A. General: The air distribution system shall be designed to maintain a slight positive pressurization of the building with respect to the outside. All areas shall be provided with conditioned air as required to satisfy heating, cooling, and ventilation requirements. The requirements for laboratories shall be six (6) air changes per hour (ACPH) for makeup air for fume hood and general exhaust, whichever represents the highest air flow rate and shall generally be negative with respect to the surrounding areas. When the room sensible heat gain exceeds the six (6) ACPH, provide a sensible cooling system as indicated elsewhere in these standards. Minimum requirements for all other occupied spaces shall be one (1.0) CFM per square foot of floor area.
B. Mechanical Equipment Spaces: For mechanical equipment spaces where positive ventilation is required, such as rooms housing atmospheric burners, the minimum air change rate shall be twelve (12) air changes per hour. Intermittent, thermostatically controlled supply air is acceptable, provided that sufficient combustion air is provided during burner operation.

C. Future Expansion: Future expansion capability shall be incorporated into the air distribution system design. The degree of expansion shall be coordinated with UMB.
D. Ventilation: Ventilation for mechanical rooms housing refrigerating equipment shall be designed in accordance with the latest ASHRAE Standards.
E. Supply Air Temperature: Conventional supply air systems shall be designed with a supply air temperature of not less than 55^0F.
F. Re-Circulating Air Systems: Where re-circulating air handling systems are used and the minimum outside air requirements are 40% or less, do not provide a preheat coil in the design. The chilled water coil shall be designed to function as a dual temperature coil for heating, as required to permit heat recovery. For ventilation air control provide a Co_2 sensor. Coordinate with UMB for using energy recovery wheels for heat recovery.
G. Heat Recovery: Where 100% outside air systems are used, include in the design a heat recovery run-around loop using 40% glycol or a heat wheel system. The maximum operating temperature in the heat recovery loop is typically 80^0F. Coordinate with UMB for using energy recovery wheels for heat recovery.
H. Reheat Systems: Where reheat systems are used, the maximum reheat water temperature supplied to the reheat coils shall be 160^0F, with a reset control based on outdoor air temperature included in the design. Where heat recovery from steam condensate is incorporated, the reheat system, including reheat coil selection, shall be designed for a lower entering water temperature of 140^0F.

22.12 Laboratory HVAC Design For New And/or Renovation Projects:

A. Design Intent: The intent of the laboratory HVAC design is to standardize the use of materials, equipment, and systems for all new laboratory installations and all laboratory renovation projects. The A/E shall discuss with UMB the selection of all material and equipment prior to proceeding with the design.
B. General Laboratory Requirements: Standard laboratory requirements shall include but not be limited to the following:

1. Designs: All designs shall include the use of constant volume and/or VAV terminal units with reheat for supply air from the 100% outside air units, constant volume general exhaust terminal units, and constant volume exhaust terminal units for general purpose low flow fume hoods connected to the building general exhaust systems. When special purpose fume hoods are required provide dedicated exhaust systems for each hood. All terminal controls shall be DDC.
2. General Purpose Low Flow Fume Hoods: The use of general purpose low flow fume hoods with a bypass is required for all projects at UMB. In general, fume hoods will have a ventilated chemical storage cabinet beneath the hood and the exhaust volume from this cabinet must be accommodated in the hood exhaust connection. When flammable storage cabinets are required, the cabinet shall be located next to the general purpose fume hood and the cabinet shall be provided with a connection to the exhaust system. ventilation duct connected to the fume hood exhaust duct above the fume hood. The exhaust terminal unit and exhaust ductwork serving the low flow general purpose fume hoods shall be sized for a face velocity of one hundred (100) fpm through an eighteen (18) inch high sash opening and have the ability to maintain eighty (80) FPM face velocity.
3. Special Purpose Fume Hoods: The use of special purpose fume hoods shall be limited to laboratory areas where perchloric acid and/or radioisotopes are used. All

special purpose fume hoods shall come with a lockable storage cabinet. The exhaust terminal unit and exhaust ductwork serving special purpose fume hoods shall be sized for a face velocity of 100 fpm through an eighteen (18) inch high sash opening.

4. Room Control: Laboratories and equipment support spaces shall have individual room control with supply and exhaust terminals, unless otherwise directed by UMB. Administrative spaces with the same exposure shall be grouped together with three (3) spaces on a single room sensor unless otherwise directed by UMB.

C. Special Laboratory Requirements: Special laboratory requirements shall include but not be limited to the following:

1. Laboratories with General Purpose Low Flow Fume Hoods: In laboratory areas with general purpose low flow fume hoods include a terminal reheat unit (TRU) for supply air and an exhaust terminal unit (ETU) for the room's general exhaust with VAV controls. For the general purpose low flow fume hoods, connected to the building's general exhaust, include an ETU with constant volume (CV) controls. The TRU will track the ETU to maintain the proper room environment and room pressurization while the fume hood general exhaust will maintain the proper exhaust air volume for the hood. Where general purpose low flow fume hoods are connected to a dedicated exhaust fan, the ETU for the hood is not required, however if the ventilation system is VAV include VFD for the dedicated exhaust fan and incorporate into the room pressurization control.
2. Laboratories with Special Purpose Fume Hoods: In laboratory areas with special purpose fume hoods for perchloric acid or radioactive usage include a terminal reheat unit (TRU) for supply air with CV controls. Exhaust the fume hoods through a pair of dedicated exhaust fans for each hood. Coordinate with UMB for required face velocity.
3. Laboratories with Existing General Purpose Fume Hoods: In laboratory areas where the existing general purpose fume hoods are to remain, and/or be reused from another location include a terminal reheat unit (TRU) for supply air and an exhaust terminal unit (ETU) for the room's general exhaust. The TRU will track the ETU to maintain the proper room environment and room pressurization.
4. Laboratories without General Purpose Fume Hoods: In laboratories without general purpose fume hoods include a TRU for supply air and an ETU for the room's general exhaust. The TRU will track the ETU to maintain the proper room environment and room pressurization.
5. Biological Safety Level 2 Laboratories (BSL-2): In BSL-2 laboratories include a TRU for supply air and an exhaust terminal unit (ETU) for the room's general exhaust. The TRU will track the ETU to maintain the proper room environment and room pressurization. The biological safety cabinet (BSC) must be installed so that the fluctuations of the room air supply and exhaust do not interfere with the proper operation of the BSC.
    a. Biological Safety Cabinet (BSC) Exhaust: For biological safety cabinets (BSC) with exhaust connection, provide a dedicated exhaust fan.
6. Biological Safety Level 3 Laboratories (BSL-3): A/E design team must coordinate the designs for biological safety level 3 areas with UMB.

7. Animal Biological Safety Level 3 Laboratories (ABSL-3): A/E design team must coordinate the designs for animal biological safety level 3 areas with UMB.
8. Surgery Laboratories, Survival and/or Non - Survival: In surgery laboratories, survival, and/or non-survival, include a TRU for supply air and an exhaust terminal unit (ETU) for the room's general exhaust. The TRU will track the ETU to maintain the proper room environment and room pressurization. Coordinate with UMB for requirements for survival and/or non- survival surgery laboratories.
9. Animal Holding Rooms: In animal holding rooms include a TRU for supply air and an exhaust terminal unit (ETU) for the room's general exhaust. The TRU will track the ETU to maintain the proper room environment and room pressurization.
10. Tissue Culture Rooms: In tissue culture laboratories include a TRU for supply air and an exhaust terminal unit (ETU) for the room's general exhaust. The TRU will track the ETU to maintain the proper room environment and room pressurization.
11. Administrative Support Areas: In administrative support areas include a TRU for supply air and an exhaust terminal unit (ETU) for the room's general exhaust with VAV controls. The TRU will track the ETU to maintain the proper room environment and room pressurization.
12. Equipment Rooms: In equipment rooms provide water cooled supplemental A/C Units connected to the building's process cooling water loop system sized for the sensible cooling load of the room. Coordinate the system requirements with UMB. These units shall be controlled and monitored by the building automation system. Provide ventilation air to these rooms from TRU's and ETU's serving adjacent areas.

D. Room Pressurization Requirements: Rooms shall be negative or positive to corridors with individual room control with supply and exhaust terminals, and related controls. Provide Room pressurization relative to the corridor as indicated below unless otherwise directed by UMB:

1. Laboratory Room Pressurization: Provide exhaust terminal units to control the general exhaust and/or fume hood exhaust air volume to a minimum of 100 CFM per door leaf above the supply ventilation air volume to ensure the laboratory is negative to the surrounding rooms. Supply terminal unit(s) shall track the exhaust terminal units to provide the required air volume differential between supply and exhaust to maintain a negative pressure in the laboratory.
2. General Room Pressurization: Non-laboratory areas such as offices, conference rooms, and other administrative areas shall be provided with positive pressurization. Provide exhaust terminal units to control the general exhaust air volume to a minimum of 100 CFM below the supply ventilation air volume to ensure the spaces are positive to the corridors and adjacent areas. Supply terminal unit(s) shall track the exhaust terminal units to provide the required air volume differential between supply and exhaust to maintain a positive pressure in the space.

22.13 Air Filters:

A. Air Filter Requirements: Air filters shall comply with the NBS dust spot test method or ASHRAE test method. Provide filters for HVAC Systems and Special Exhaust Systems as required by the project requirements.

1. HVAC Systems: Includes air handling units, energy recovery units, terminal heating and / or cooling units using filter media.

2. Special Exhaust Systems: Includes bag in / bag out filter housings for radioactive exhaust from special laboratories and BSL exhaust.
3. Filter Media Types: Filter media shall include a combination of pre filters, intermediate filters, and final filters for the intended applications. See UMB Master Specifications Division 23 for additional filter requirements and types.

B. Selection of Filters: Select filters for maximum operating velocity of four hundred (400) FPM to give an economic combination of static pressure loss and dust-holding capacity.

C. Access Door: Provide a hinged access door with a minimum width of eighteen (18) inches and sized as necessary for filter removal/replacement. Coordinate with the A/E team to provide access to filter assemblies. Where 95% efficiency filters are required, the design shall include walk-in access doors, and the filter frames shall provide for front load clip type filter holders. Side load track type filter frames are not acceptable.

D. Filter Housings: Filter housings shall not be installed above ceilings in labs, or above plaster or inaccessible ceilings. Bag–in/bag–out filter housing assemblies shall be located in an accessible area on the roof level of the building.

22.14 Air Terminal Units:

A. Supply Terminal Reheat Units:

1. Supply Terminal reheat units (STRU) shall be specified to be provided with a factory mounted control enclosure, removable velocity sensor, reheat coil with access door, antimicrobial insulation and all necessary DDC controls mounted in a control enclosure on the side of each STRU.
2. Reheat coils shall be a minimum of two (2) rows. Each coil shall be sized for the air pressure drop at the maximum air flow with 55^0F entering air temperature and 90^0F leaving air temperature and 150^0F average water temperature (160^0F -140^0F). Where it is deemed appropriate by UMB, reheat coils shall be selected for performance with an entering water temperature of 140^0F to maximize heat recovery from steam condensate systems.
3. STRU's serving laboratory areas with fume hoods shall have constant volume controls. STRU's serving laboratories without fume hoods, and laboratory equipment areas, shall have variable volume controls. STRU's serving administrative areas shall also have variable volume controls.
4. When terminal reheat, units include VAV control size the reheat coil and box for the maximum air quantity in the heating mode.

B. General Exhaust Terminal Units:

1. General exhaust terminal units (GETU) shall be specified to be provided with a factory mounted control enclosure, removable velocity sensor, and all necessary DDC controls mounted in a control enclosure on the side of each GETU. GETU's serving laboratory areas with fume hoods shall have constant volume controls. GETU's serving laboratories without fume hoods and laboratory equipment areas shall have variable volume controls. GETU's serving administrative areas shall also have variable volume controls.

C. Return Air Terminal Units:

1. Return air exhaust terminal units (RATU) shall be specified to be provided with a factory mounted control enclosure, removable velocity sensor and all necessary DDC controls mounted in a control enclosure on the side of each RATU. RATU's shall have variable volume controls.

D. Fume Hood Exhaust Terminal Units:

1. Fume hood exhaust terminal units (FHETU) shall be specified to be provided with a factory mounted control enclosure, removable velocity sensor and all necessary DDC controls mounted in a control enclosure on the side of each FHETU. FHETU's shall have constant volume controls.

E. Air Terminal Unit Access: To minimize disruption to occupants during periodic maintenance, locate air terminal units above corridors or other transient spaces wherever possible. Location must provide points of access to the control panel, reheat coil, velocity sensor, and reheat control valve.

22.15 Air Duct Systems:

A. Design Requirements:

1. Either the equal friction method or the static pressure regain method in the ASHRAE Fundamentals Handbook may be used to determine duct sizes. Use, the static regain method for high velocity systems.
2. Where ducts are connected to equipment housings, transition should be smooth, with a transition no greater than fifteen (15) degrees on the upstream side and no less than thirty (30) degrees on the downstream side. Avoid transitions in elbows. All duct distribution systems shall be efficiently designed with a minimum of fittings, and with economical duct routing. System design shall be modified or re-routed where directed by UMB without additional cost or time delay where UMB has determined that the duct layout as designed is not in the best interest of UMB.
3. Provide hinged access doors or panels no smaller than eighteen (18) inch x eighteen (18) inch in ductwork for maintenance, inspection, and service for:
    a. Filters.
    b. Cooling coils and heating coils.
    c. Sound absorbers.
    d. Fire and smoke dampers.
    e. Controls (dampers, switches, relays, sensing devices, etc.).
    f. Coordinate with the A/E team to provide access openings through finished construction. Show locations of all access doors on drawings and in details.
4. Generally, use galvanized sheet metal ductwork. Construction is to be per SMACNA Standards. Flexible ductwork to air terminal devices, i.e., VAV and constant volume boxes, diffusers, etc., shall not be permitted. Experience at UMB has shown that flexible ducts are very susceptible to leakage, damage, and kinking. Where budget constraints exist, flexible ductwork may be permitted if restricted to a maximum length of five (5) feet for final connections to diffusers. No designs shall include the use of flexible ductwork unless permission is specifically granted by UMB for a specific project or location.
5. Ductwork and related equipment shall be supported from the building structure and shall be isolated from vibration.

6. Design shall include the anticipated operating pressure of every duct system and the calculated pressure drop for system components, such as dirty filters, wet coils, plenums, dampers, sound attenuators, AHU accessories, terminal devices, dampers. Isolation smoke dampers for AHU's and exhaust fans shall be selected to have the capability of shutting off against the maximum fan pressure.
7. All ductwork shall be specified to be sealed using mineral impregnated woven fiber tape equal to Hardcast, Inc., and all seams and joints shall be sealed, including longitudinal seams.
8. All ductwork, including low pressure duct over fifteen (15) feet in length, shall be leak tested using the method prescribed by UMB.
9. Acoustic and thermal duct liner may be used for noise control in ductwork and terminal reheat units provided the material specified is non-porous engineered polymer foam closed cell insulation. Provide sound attenuators at the discharge and return of all AHU's, fans and terminal reheat units where needed for noise control.

B. Dampers: Provide manual volume dampers in every air distribution device branch duct and where it is necessary to obtain proper control, balancing, and distribution. For ducts sized twelve (12) inches and larger, specify opposed blade volume dampers. Use self-closing, gravity-operated or motor-operated dampers to stop back flows of air. Locate fire and/or smoke dampers in accordance with NFPA; refer to local fire codes for use, location, and construction. Show all dampers on drawings, with access doors.
C. Duct Riser Labels: Provide labels for duct risers on floor plans part plans, details and diagrams indicating what equipment is serving the duct risers. Coordinate requirements with UMB. See examples below:

DUCT RISER	LABEL
Supply Duct and/or Return Duct	AHU #X
General Exhaust Duct	GEF #X
Fume Hood Exhaust Duct	FHEF #X
Cage Washer Exhaust Duct	CWEF #X

22.16 Air Distribution Devices:

A. Locate supply air outlets to provide proper throw, drop, and spread. Air should not blow against obstructions such as beams, columns, and lights, and should not blow on occupants.
B. Locate supply outlets uniformly and within the range of throw to distributed loads, and coordinate with architectural layout and ceiling grid. If loads are concentrated, locate supply outlets near the load source.
C. Select air distribution devices for variable air-volume systems (VAV) to be compatible with characteristics of the VAV system. The devices must be capable of performing at full and partial load.
D. Locate exhaust/return outlets to ensure proper air distribution is provided without inducing short circuiting air flows.

22.17 Exhaust Systems:

A. General Exhaust Systems: General exhaust systems shall be designed for toilet rooms, janitor closets, storage rooms, mechanical and electrical rooms, utility areas, and areas with kitchenettes or pantry sinks, with rates as established by ventilation requirements. General laboratory exhaust may be combined with fume hood exhaust where a manifolded or combined system is used, but the laboratory exhaust systems shall be kept separate from all other building exhaust systems. Sufficient make-up air for all exhaust systems shall be provided, conditioned as appropriate.
B. Special Exhaust Systems: Exhaust air containing toxic material, viruses, radioactivity, or undesirable odors shall require special treatment before being released into the atmosphere and should be discharged as far away from air intakes as possible. The proximity of air intake and exhaust to nearby buildings shall be considered in the design to ensure a suitable air quality in the buildings. Adequate discharge height, location, wind direction, etc. for exhausted air contaminants shall be determined. Design all necessary controls and separate systems for special exhaust, such as perchloric acid exhaust with duct and hood wash down. For systems requiring filtration design a bag-in/bag-out filter assembly complete with standby fans, controls, including isolation dampers support details, and air monitoring devices necessary or as directed by UMB and/or EHS Department.
C. Fume Hood Exhaust Systems: Fume hood systems, such as manifolded systems and variable air volume systems, shall be presented for UMB review during the Schematic Design Phase. Where such systems are approved by UMB, a dedicated exhaust terminal unit shall be designed for each fume hood to maintain proper exhaust air flow. Recommended duct velocity should be between 1,000 and 2,000 feet per minute.
    1. Information from the User: User shall supply a list of hazardous substances which will be used in the hood or cabinet.
    2. Manifold Systems: Where combined or manifolded exhaust systems are permitted by UMB, the common manifold exhaust duct may be constructed of galvanized steel where sufficient dilution of the corrosive air stream is anticipated. The duct run outs to each fume hood shall be stainless steel.
    3. Filter Systems: Fume hood exhaust systems requiring filtration must be provided with a bag in/bag out filter housing assembly, appropriate filter media, positive shut off isolation dampers at the inlet and outlet of each filter housing assembly, two (2) exhaust fans connected to emergency power (one (1) stand by) and all necessary supports, flashing details etc. These systems shall be completely independent of the central fume hood and general exhaust systems.
D. Energy Recovery Systems: The use of energy recovery systems between exhaust and supply air systems shall be designed where economically feasible or where requested by UMB. A hydronic, run-around loop, heat pipe, or heat wheel system shall be used. Heating and cooling load calculations shall be performed using ASHRAE methods. If fume hood exhaust is part of the general exhaust system and sufficient dilution is attained, all of the exhaust air may be used in a heat recovery system. Separated fume hood exhaust shall not be used in heat recovery systems unless specifically approved by UMB. When a heat wheel energy recovery system is designed the engineer shall size the cooling coil and heating coil for the full ΔT needed if the wheel fails.
E. System Diagrams: Provide complete diagrams for each HVAC air system. See Chapter 2 in the UMB Procedure Manual for A/E Professional Services for requirements.

22.18 Automatic Temperature Control (ATC):

A. General: Provide DDC automatic temperature controls for HVAC systems. Include controls to maintain dead-band temperature ranges, to control air-conditioning, and to reset temperatures during periods of non-occupancy. If smoke control is provided, coordinate controls and systems. Coordinate automatic controls with the existing campus central control and monitoring systems, manufactured and installed by Siemens Building Technologies, Johnson Controls and Delta. During the design review process, the University will determine which of the control vendors shall be specified. The project shall include the necessary cabling to interface the building with the campus automation system Ethernet connections between devices in the project shall be coordinated with UMB and/or the communications consultant. Delineate the pneumatic, electronic, or electric type, with standard symbols, schedules, descriptions of operation, sequences, throttling ranges, set points, etc., as part of the design. Show room thermostats or sensors on floor plans, and coordinate all locations with the A/E team for conflicts with furnishings, finishes, equipment, etc.

B. Control Sequences: The consultant shall use the control sequences of operation in the UMB master specs. Provide control sequences that are not included in the UMB master specs as necessary. Coordinate all automatic temperature control sequences with UMB. See UMB Specification Section 230900 “Building Automation Systems - Renovation Projects” for control sequences.

C. Individual Room Control: Provide individual room control for all private offices, classrooms, laboratories, conference rooms and all other special use areas as required by UMB. Where offices have similar loads and exposures, these spaces may be grouped together on a single temperature control point at the option of UMB. Limit grouped spaces to three (3) per control point.

D. Room Pressurization Control: Provide individual room pressurization for research laboratories as required by the project program or as directed by the UMB. All research laboratory spaces shall be designed to be negative to the surrounding spaces.

E. Room Terminal Unit Tracking: When room supply terminals, room exhaust/return terminals, and/or fume hood exhaust terminals are required by the project program, or as directed by UMB, these terminal units shall be interlocked together through the BAS to track the room air volumes to maintain the rooms set point and pressurization in the occupied and unoccupied modes of control. Supply terminals shall track the exhaust terminals to maintain the required room pressurization.

F. Room Humidity Control: When required by the project program or as directed by UMB include in the design individual room humidification. Control shall be through the BAS. Coordinate with UMB for the type of humidification system proposed by the engineer. Humidification systems shall be designed for individual space control only.

G. Energy Flow Measurement: Provide energy and flow measurement devices in primary, and building secondary chilled water systems, and in secondary process cooling water systems, import/export chilled water systems, condenser water systems, and steam service. All energy and flow measurement devices shall be IP based and capable of sending the recorded data to the campus automation system and/or the campus energy management system. Coordinate all requirements with UMB.

H. Enthalpy Control: Include enthalpy control as part of the BAS design as directed by the University or as required by the project program. Coordinate the requirements of this control sequence with UMB.

I. Fire Alarm and Security Systems: Provide the required integration of ATC with the fire alarm and security systems as required by the project program or as directed by UMB. For additional information see Chapter 26: Fire Alarm, Safety, and Security Systems Design of these Design Standards. Coordinate all requirements with UMB.
J. UMB Renovation Projects: For renovation projects where equipment with DDC controls are either added, relocated, or removed and replaced with new equipment with DDC controls, include in the design the requirements for system program and graphic modifications to the BAS. Coordinate all requirements with UMB.
K. Occupancy Based Control: Specify occupancy sensors and programming for all rooms and spaces where intermittent occupancy is anticipated, such as conference rooms, meeting rooms, corridors, and toilet rooms. The occupancy sensor shall control the lighting and terminal reheat units serving the space.
L. Unoccupied Periods: Provide automatic controls and programming to permit re-setting of room temperature controls and room supply and/or exhaust rates during the unoccupied periods, as directed by UMB.
M. Floor ATC Closets: In buildings without an accessible central utility core, or mechanical rooms on each floor the design team shall include ATC closets on each floor for DDC controls. Each ATC closet shall have sufficient space for at least four (4) panels. Each closet shall be accessible from a corridor through a pair of double doors and shall be a minimum of sixteen (16) square feet (eight (8) feet long x two (2) feet deep). The A/E team shall include these closets in the space planning phase of the project.
N. Alarm Monitoring: In addition to the requirement for monitoring the operation of all mechanical and electrical equipment and systems, there are additional specific locations and systems that shall be monitored as well. These include:

    1. Elevator sump pumps, including pump status and high level alarm.
    2. Elevator travel signals.
    3. Temperature and humidity levels in elevator machine rooms and server rooms.

O. UMB Master BAS Point List: UMB will provide point lists for all HVAC equipment to be connected with the campus central control and monitoring system. The engineer shall use and edit the UMB master BAS point list for the project. These point lists shall be included in the contract documents.

22.19 Special HVAC Wastes:

A. All air conditioning condensate shall drain to the storm water system.
B. All steam condensate shall be cooled by mixing with domestic cold water, using an economizer tank for preheating domestic hot water where feasible, and drain to the storm water system. Steam condensate shall be cooled to a temperature below 140^0F before discharging into the storm water system.
C. All cooling tower drain piping shall be piped to the storm water system.

End of Chapter

Chapter 23: Electrical Design General Requirements

Amended 09-19-2022, See underlined text

23.1 Scope:

A. This division provides general objectives and criteria for designing electrical systems. It deals with general purpose office, research, and instructional buildings; however, principles herein shall be followed, where applicable, for special-purpose buildings. Many of the existing systems serving the UMB buildings may not be in compliance with these current standards due to their age. However, it is the intent that all design of both new and renovated systems be done in accordance with these Design Standards. Instances where existing conditions preclude compliance with the standards should be brought to the attention of UMB for discussion and resolution.

B. The electrical engineering design shall consist of, but not necessarily be limited to, the design of:

1. Power and lighting systems
2. Security systems
3. Fire alarm system
4. Data and voice communication systems.

C. The design shall include all work required to provide a complete and operating facility, including the following tasks, as necessary for each system and as applicable to the project:

1. Investigation of field conditions, including existing equipment name plates.
2. Obtaining data from manufacturers.
3. Establishing the levels of the system and equipment reliability required for the design based on consultation with UMB, and incorporation of the reliability levels in the design.
4. Field measurements of physical sizes of equipment and spaces, and power, current, voltage, transient voltage, etc. all recorded over sufficient time to establish a trend.
5. Perform necessary calculations as defined in the project contract and as directed by UMB Design and Construction.
6. Analysis of data and engineering calculations, including preparation of necessary tabulations, graphs, etc.
7. Study of equipment and apparatus operating methods to ascertain the applicability, and comparison of advantages and disadvantages, including maintainability.
8. Preparation of cost estimates and comparisons.
9. Engineering recommendations, listing advantages and disadvantages.
10. Coordination with the A/E team to confirm that the equipment and light fixtures will fit such that the equipment or light fixtures are readily accessible for maintenance and that power sources are provided where needed. Where power sources are installed at remote location, it shall be readily accessible for maintenance.
11. Participation in discussions with UMB users, D&C engineers, O&M staff, and other professional consultants in the selection of the various systems, methods, equipment, etc.
12. Preparation of reports, design phase drawings and specifications and construction contract documents.

13. Identification of major installations and/or testing which must be witnessed by UMB representatives, and inclusion of these requirements with specific testing criteria in the Specifications.
    a. **Note:** The purpose is to identify problems as early in construction as possible, so corrections can be made without effecting completion of the building as scheduled.
14. Participation in, and/or the conduct of, a sequence of acceptance tests, to be performed as soon as a system or piece of equipment is installed.
15. Approach to system design, for each system.
    a. Review of current equipment available to accomplish the required function.
    b. Establish the reliability and maintainability required of the system in consultation with UMB.
    c. Identify and discuss with UMB the advantages and disadvantages, including impact on cost and schedule, of available types of equipment.
    d. Select in consultation with UMB, and to satisfy reliability and maintainability requirements.
    e. Identify configuration of the system and the type of equipment to best accomplish the proposed function in consultation with UMB. Justify by reasoning, application, performance, maintenance, reliability, and value considerations.
    f. Make calculations to establish the capacity of the system and the size of components, with allowance for future growth.
    g. Establish routing of wiring or other interconnecting requirements, including interface with existing systems.
    h. Prepare drawings, including schematics, wiring diagrams and details that establish and define the installation, and prepare contract Specifications as established by prior consultation with UMB.

D. **Short Circuit & Coordination Study & Arc Flash Hazard Analysis:** A short circuit and coordination study and arc flash hazard analysis study shall be prepared for the electrical over current devices to be installed to assure proper equipment and personnel protection. The complete study and report shall include a system one line diagram, short circuit and ground fault analysis, arc flash hazard analysis and protective coordination plots.

1. **Drawing Submission:** The 95% Contract Document review submission shall include a short circuit and coordination study and Arc flash hazard analysis study in accordance with IEEE and NFPA. The protective device study shall be prepared by qualified engineers and the study shall be calculated by means of a computer program. The review submission shall include, as a minimum, the following information:
    a. **One Line Diagram:** On the one-line diagram include;
        i. All electrical equipment and wiring to be protected by the
        ii. overcurrent devices installed. Clearly show, on the one line, the schematic wiring of the electrical distribution system.
        iii. Calculated fault impedance, X/R ratios, and short circuit
        iv. values at each bus.

v. Breaker and fuse ratings.
vi. Generator kW and Transformer kVA and voltage ratings,
vii. percent impedance, X/R ratios, and wiring connections.
viii. Voltage at each bus.
ix. Overall voltage drop.
x. Identification of each bus.
xi. Conduit material, feeder sizes, length, and X/R
xii. ratios.

2. Short Circuit Study:

a. Systematically calculate the fault impedance to determine
b. the available short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.
c. The study shall be calculated by means of a computer
d. program. Pertinent data and the rationale employed in developing the calculations shall be incorporated in the introductory remarks of the study.
e. Present the data determined by the short circuit study in a
f. table format. Include the following:
g. Device identification.
h. Operating voltage.
i. Protective device.
j. Device rating.
k. Calculated short circuit current.

3. Coordination Curves:

a. Prepare the coordination curves to determine the required
b. settings of protective devices to assure selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between series devices, including the utility company upstream device. Plot the specific time-current characteristics of each protective device in such a manner that all upstream devices will be clearly depicted on one sheet.
c. The following specific information shall also be shown on the coordination curves:

i. Device identification.
ii. Voltage and current ratio for curves.
iii. Three (3) phase and single (1) phase ANSI damage points for each transformer.
iv. No-damage, melting, and clearing curves for fuses.
v. Cable damage curves.
vi. Transformer inrush points.
vii. Maximum short circuit cutoff point.

d. Develop a table to summarize the settings selected for the protective devices. Include the following in the table:

i. Device identification.
ii. Relay CT ratios, tap, time dial, and instantaneous pickup.
iii. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.

iv. Fuse rating and type.
v. Ground fault pickup and time delay.

e. The arc flash hazard analysis shall be performed in accordance with current standards of the IEEE 1584 equations that are presented in NFPA 70E.
f. The arc flash hazard analysis shall include recommendations to correct any conditions showing the incident energy level in excess of 40 calories/sq cm or 167 joules/sq cm.

23.2 Design Submissions:

A. The A/E shall submit design document, proposals, drawings, sketches, calculations, specifications, etc. at various stages in the design process. For electrical requirements of each submission, refer to this division and the UMB Procedure Manual for Professional Architectural and Engineering Services for UMB Construction and UMB Service Centers, latest edition.

23.3 Codes, Standards And Regulations:

A. **Codes:** The design shall comply with the codes, standards, and regulations listed in Chapter 3: Building Codes and Review Agencies of these Design Standards, and at a minimum, with the most recent edition of all the codes that have been adopted by the State of Maryland. The technical requirements of these codes shall supplement all other standards, codes and regulations imposed by the University which may be initiated subsequent to the program preparation. The UMB Fire Marshal shall review all design documents when required to meet code. When a specific project warrants variance from the governing codes and regulations, a request shall be submitted in writing to UMB at the Schematic Design Phase. Unless otherwise noted the latest edition of the codes in effect at the time the design contract is awarded will be used throughout the design and construction of that project.
B. **Standards and Regulations:** In addition to those codes, referenced above, the basis for electrical design shall also include amendments and revisions, of the following standards and regulations:

1. National Electrical Manufacturers Association (NEMA),
2. Institute of Electrical and Electronics Engineers (IEEE),
3. Edison Electric Institute (EEI),
4. Electronic Industries Application (EIA),
5. Insulated Power Cable Engineers Association (IPCEA),
6. Certified Ballast Manufacturers Association (CBM),
7. American National Standards Institute (ANSI),
8. American Society of Mechanical Engineers (ASME),
9. American Concrete Institute (ACI),
10. Underwriters Laboratories, Inc. (UL),
11. Illuminating Engineering Society of North America (IES),
12. Rules and regulations of the Baltimore Gas and Electric Company,
13. Regulations of agencies having jurisdiction over State of Maryland construction, such as the EPA, ADA and OSHA.

23.4 Coordination:

A. **Electrical Design:** The electrical design must be coordinated with the civil, architectural, structural, mechanical, fire protection, tele-data. and specialty designs to permit the A/E submissions and reviews by UMB to be made effectively.
B. Exterior and interior exposed electrical items shall be indicated, and coordinated, with the A/E team. The items involved shall be identified, along with their physical characteristics, including clearances, finish materials, etc. Coordination with all disciplines shall include location and sizes of electrical devices with accommodation of other equipment, furnishings, finishes, etc.

    1. **Example:** Equipment and devices, such as security hardware, which require electrical power or electrical trade work shall be coordinated for requirements and specifically indicated in the construction documentation.

C. **Site Visits:** On a renovation or alteration project, the engineer shall make necessary visits to the site to ensure coordination with existing conditions and to make certain that there is adequate space and service clearance for the proposed layout and equipment. The engineer shall not rely solely on original construction document or earlier renovation drawings, as they may not represent the actual existing conditions. The A/E team shall check building dimensions to confirm the accuracy of archived record drawings.

23.5 Economical Design:

A. **General:** Electrical systems shall be designed to permit acceptable competitive bids. Equipment and systems shall be efficient and economical for construction and maintenance.
B. **Equipment Selection:** Equipment specified should be nonproprietary, except where no other source is available to meet performance requirements. Where a proprietary selection is deemed necessary, a request shall be submitted in writing to UMB early in the design stage. Materials selected shall be suitable for the application and shall be coordinated with other aspects of the project.

23.6 General Design Considerations:

A. **Electronic Drawing Files:** The A/E shall prepare electronic drawings, utilizing the UMB standard drawing templates, in accordance with the requirements in Chapter 28: Electronic Files of these Design Standards. The UMB standard drawing templates can be accessed through the UMB Design & Construction web page.
B. **Paper Design Documents:** The A/E shall provide paper copies of the drawings and specs upon request by UMB.

    1. **General Project Files:** Non CAD type project files such as fee proposals, studies, reports, cost estimates, calculations, and specifications shall be submitted to UMB electronically.
    2. **Floor Plans and Details:** Full size floor plans shall be drawn to a minimum scale of one eighth (1/8) inch per foot. Floor plans for mechanical equipment rooms, main electric room, electric rooms, BDF & IDF rooms, server rooms, emergency generator room, fire command center and all other areas where space conditions are such that close coordination between all disciplines is necessary shall be drawn to a minimum scale of one quarter (1/4) inch per foot. Where scaled details are necessary to indicate coordination between materials and equipment utilize a minimum scale of one half (1/2) inch per foot. Drawings shall be coordinated with

the respective trades, and cross-sections and elevations provided. All floor plans shall include room numbers as indicated on the architectural drawings.

3. **UMB's Sustainability Policy:** In accordance with the University's Core Values of Well-Being and Sustainability, the integration of sustainable and green building practices in the design of all renovation and new building projects is essential, regardless of the intent to meet LEED™ certification requirements.

    a. The A/E team is encouraged to investigate and recommend the use of innovative and state-of-the-art use of materials, equipment, systems, and design approaches that hold promise for increases in energy efficiency, resource reuse and recycling, reduced energy consumption, and improved indoor air quality, operational efficiencies, and thermal performance of the project space.
    b. Where the intended use of such design practices conflicts with these Design Standards, the A/E team shall notify UMB during the Schematic Design phase, or as soon as possible thereafter, so that a discussion of the issues can be held and resolution can be reached. The engineer shall explore opportunities for the integration of discipline specific initiatives for sustainable design in the project as the design effort progresses.
    c. Specific design initiatives in the area of the electrical design could include, but are not limited to, use of recycled and salvaged materials and equipment, use of recyclable materials, use of occupancy sensors for lighting and HVAC control, daylighting techniques, local switching to accommodate varying occupancy schedules within the space, use of smart breakers, and integration of raised floors for future flexibility and ease of utility routing.
    d. In addition, the A/E shall include requirements for recycling of demolition and construction waste materials in the construction documents and report waste diverted to the Office of Sustainability at regular intervals.

4. **Interferences:** Coordinate the design with the structural and architectural system components to avoid interference and conflicts. Particular attention shall be given to avoidance of structural components, including beams, columns, bracing, column caps and concrete reinforcement, and to ensure that all equipment and distribution systems fit adequately above intended ceiling heights. Coordinate the routing of all systems with all work of other disciplines. Coordinate with mechanical and plumbing equipment to avoid use to drip pans above electrical equipment. Consider space required for access for maintenance and repair of equipment.

C. **Foundation Drawings:** If construction of a foundation is to proceed in advance of completion of the superstructure drawings, separate working drawings of foundations are required. These drawings shall show:

1. Electrical work that cannot be installed later. This includes piping and conduits below or through foundations, slabs, etc.

23.7 Specifications And Substitutions:

A. **General:** In addition to the requirements in this part see UMB Procedure Manual for Professional Architectural and Engineering Services for UMB Construction and UMB Service Centers, latest edition.
B. Electrical Specifications:

1. A project specification incorporating sections for electrical work shall be prepared, coordinated with drawings, and submitted. UMB has developed a complete set of master specifications for mechanical and electrical divisions, and selected architectural sections, and general requirement sections. The A/E shall review the UMB master specifications table of contents, included in the Appendices of these Design Standards, and select from the UMB web page all appropriate specification sections necessary to suit the current project scope. The A/E shall edit the UMB master specification sections to suit the requirements of the project. The A/E shall utilize their own specifications and/or other resources only in those cases where the UMB master specifications do not include the required equipment, materials, or construction procedures to suit the current project. The UMB master specifications can be accessed through the UMB Design & Construction web page. All text in the header, footer and body of each specification section shall be "Times New Roman, Size 12".
2. For UMB design projects that do not require a full set of electrical specifications, UMB has a condensed version of electrical specifications that should be used for these projects. The UMB condensed specifications can be accessed through the UMB Design & Construction web page
3. **Inspection Certificates:** For major projects, include in the project specifications the following:
    a. The contractor is required to provide an electrical certificate from an independent electrical inspection agency approved by the Maryland State Fire Marshal.
    b. The electrical contractor shall file with the approved inspection agency prior to the start of construction so that adequate rough-in inspection may be made during the course of construction.
    c. The contractor shall be responsible for all fees associated with this inspection.

C. **Substitutions:** For specification sections provided by the A/E that are not based on the UMB Master Specifications, the specification sections shall include the names of at least three manufacturers for every product. The engineer shall ascertain that every manufacturer listed is acceptable to UMB, and that every manufacturer listed can provide a product that is acceptable in terms of performance, quality, size, service access and orientation. Even though the engineer may identify one manufacturer's product as the design basis, the other manufacturers' products will not be viewed as substitutions, but as approved equals. In addition, other manufacturers' products which are not listed, but can be considered as approved equals, shall not be viewed as substitutions. Only manufacturers' products which are not approved equals because of a deficiency in one or more significant aspects of the product will be considered to be substitutions. The design shall include sufficient space and service clearance such that all equal products can be used.

23.8 Service Access:

A. **Access to Machines and Equipment:** Clearance shall be provided around machines and equipment to remove parts for repair or replacement. Door or window openings, removable panels in building walls, and corridors shall be arranged so that large machines or equipment parts can be removed or replaced without structural changes or movement of other equipment.

1. The engineer shall arrange with the architect to provide openings and passageways of sufficient size so that standard equipment can be used.
2. Particular attention shall be given to equipment such as high voltage switch gear, motor control centers and transformers.
3. Accessible utility core spaces shall be provided for all major mechanical and electric utilities. Access through full-size man doors shall be provided. These spaces shall have adequate clearance for maintenance and future replacement of the equipment, risers, and conduits with a minimum of three (3) feet between equipment and structural components or as in compliance with codes or manufacturer's recommendations.
4. Adequate space must be provided for possible future additional duct and pipe risers, conduits, and equipment. Provide adequate clearance for maintenance and repair.
5. Designs which indicate the routing of piping, ductwork, and conduits across the floor within the path of travel for service or maintenance personnel will not be acceptable to UMB, nor shall piping, ductwork, and conduits be designed which would create a low clearance hazard.
6. There shall be a minimum of seven (7) feet vertical clearance within the path of travel. Where the path of travel is not obvious, or where directed by UMB, indicate the path of travel around all equipment requiring service access on the construction drawings.
7. UMB reserves the right to require a total or partial redesign of equipment layouts, at no additional cost or time delay, where the submitted design is, in the opinion of UMB, not in the best interest of UMB. Coordinate with the electrical engineer to provide adequate lighting levels in all electrical spaces for service and maintenance.

B. **Demonstration of Access:** The 50% submission shall show sketches demonstrating that at least three manufacturers' equipment is accessible and will fit with adequate clearance, as deemed acceptable by UMB.

23.9 Building Operation:

A. Except for selected shutdown holidays, UMB campus buildings are open to the public for business from 7:00 am to 6:00 pm, Monday through Friday, but many of the buildings on campus are occupied to a lesser extent at all hours of the day and night, seven (7) days per week. In buildings where public spaces and/or research spaces adjacent to the project area require other hours of operation, the design shall identify construction phasing that has the least impact on the adjacent occupied areas. The design shall include requirements for off hour work as required for work involving the shutdown of systems or equipment serving the occupied areas.

23.10 Demolition:

A. A/E shall include all necessary provisions for demolition in the construction documents. Demolition documents shall clearly define the limits of the demolition work including the disconnection and removal of all equipment and distribution systems serving the project area. A list of all equipment and systems intended for demolition, and those to be reused in the project design shall be submitted to UMB for approval. The A/E shall request from UMB a list of equipment to be identified as salvaged material to be turned over to the University.

B. The A/E shall include a phasing plan in the construction documents that indicates a method by which the work in the occupied building can be accomplished with the least possible disruption to the occupants of surrounding and adjacent spaces.
C. The plan shall include provision for all temporary power, equipment, and systems necessary to provide HVAC and plumbing services to all occupied areas interrupted by the construction work.
D. The plan shall also include the requirement for off hour work for all outages and disruption of all services to the occupied areas. The plan shall utilize, to the extent possible, the change of seasons in the calendar year to lessen the impact of system outages, performing work on heating systems in the summer months and performing work on cooling systems during the cold weather months.
E. The plan shall consider the anticipated disruption to adjacent occupied areas that will be caused by work that involves the generation of excessive noise, dust, and vibration.

23.11 Electrical Equipment Room Layouts:

A. **General:** The engineer shall work with the architect at the outset of the project to identify the sizes, shapes, and locations of required spaces as dedicated mechanical and electrical equipment rooms. These rooms shall be arranged as penthouse mechanical and electrical rooms and lower level mechanical and electrical rooms to accommodate the building plumbing, HVAC, and electrical equipment and associated pipe and duct distribution systems. Lower level mechanical and electrical rooms shall be located either on grade or above grade ~~or below grade~~ with sufficient access to loading docks and/or public streets to facilitate the removal/replacement of equipment.
B. **Room Design:** All electrical rooms shall be designed to accommodate the required equipment in accordance with the manufacturer's operating and service clearance requirements, and in accordance with the accessibility requirements of these Design Standards. Provide a telephone outlet in each mechanical room. Coordinate the locations with the A/E team and UMB. Include electrical and mechanical rooms on radio repeaters and building wifi network. Provide Distributive Antenna System (DAS) system for emergency responding teams.
C. **Separation of Mechanical and Electrical Rooms:** Separation of mechanical and electrical rooms shall be maintained, with appropriately fire rated physical barriers to prevent flow or migration of fluids from mechanical to electrical spaces.
D. **Equipment Room Stacking and Vertical Relationship to Main Electric and Tele-Data Building Distribution Frame (BDF) Rooms:** It is UMB's preference to stack all electric rooms and Tela/Data BDF closets in vertical alignment with their respective lowest level and/or penthouse level main electric rooms and between floors to facilitate the routing of wiring and conduit and to minimize cross-connect runs at lowest level or penthouse level.
E. **Electric Room Cooling:** See Chapter 19 – Mechanical Design General Requirements 19.20 Special Use Areas of these Design Standards for cooling requirements. Connect the mechanical equipment to the emergency power source.
F. **Tele-Data BDF and Intermediate Distribution Frame (IDF) Centralized Cooling:** See Chapter 19 – Mechanical Design General Requirements 19.20 Special Use Areas of these Design Standards for cooling requirements. Connect the mechanical equipment to the emergency power source.

G. **Future Equipment Space:** When directed by UMB, or as required by the project program, provide space for future equipment such as chillers, pumps, and cooling towers. For future roof mounted equipment, the design shall include the necessary structural supports and roof penetrations for piping and conduits.

H. Housekeeping Pads: Provide concrete housekeeping pads for electrical equipment intended to be floor mounted in mechanical and/or electrical rooms. Each housekeeping pad shall be constructed to support the operating weight of the equipment. The pad shall be at least four (4) inches high and extend at least two (2) inches beyond the equipment footprint on all sides. See UMB Mechanical Detail #54 for additional information. See UMB Mechanical Detail #54 for additional requirements.

I. **Electric Room Floor Seals:** To avoid dust build up inside equipment, electric room concrete floor and housekeeping pads must be sealed before equipment is installed.

23.12 Fire Stops And Smoke Seals:

A. Provide fire stops and smoke seals for all electrical conduits that pass through floor slabs, utility shaft walls, and roof levels. Coordinate with the UMB Fire Marshal, and the A/E team to ensure compliance with all code requirements.

23.13 Electric Motor Requirements:

A. For power factor requirements for each motor (10 hp or larger) or motor driven equipment, see Chapter 19: Mechanical Design General Requirements 19.18 Electric Motor Requirements of these Design Standards.

23.14 Emergency Power Requirements:

A. In addition to the life safety equipment and/or systems required by Code, include the following equipment and systems in the design of the emergency power distribution system that may apply to the project unless otherwise directed by UMB:

1. Preheat pumps and system.
2. Process cooling water pumps
3. Fire pump and jockey pump
4. Fume hood exhaust fans.
5. General exhaust fans.
6. AHU supply air fans as needed for make-up air for smoke evacuation Systems.
7. Atrium smoke evacuation systems.
8. A/C units, dry coolers and pump packages serving computer rooms, data rooms, IT closets, elevator machine rooms, electric rooms, Tela-Data, BDF, and IDF rooms.
9. Stair pressurization systems.
10. Controlled environment rooms.
11. Foundation sump pumps and sewage ejector pumps.
12. Fire alarm systems.
13. Domestic water booster pump package
14. ATC controls for the above equipment and systems, including but not limited to, cabinets, TEC's, transformers, and ATC air compressor. Coordinate with UMB for additional requirements.
15. One (1) building elevator.

23.15 Commissioning:

A. The A/E team shall include the requirement for commissioning of all mechanical, electrical, and appropriate building systems by an independent commissioning agent to be hired by UMB or the CM, as directed by the UMB. The design specifications shall include all descriptions, commissioning forms, reports, and procedures required to completely test and demonstrate the operation of systems provided by the project. The testing and demonstration of each system shall include, at a minimum, normal operation and control sequences, failure modes, monitoring and control systems, life safety operations, security operations, and all remote monitoring and notification.

23.16 University Furnished Equipment:

A. When the project includes equipment that is furnished by the university, for installation by either the vendor or the contractor, the A/E shall include the required electrical rough-ins for the basis of design equipment along with all necessary clearances as defined by the vendor.

End of Chapter

Chapter 24: Power And Lighting Systems Design

Amended 09-19-2022, See underlined text

24.1 Scope:

A. This part outlines the minimum requirements for the design procedures for the power and lighting systems, for new buildings, and repair and alteration projects for existing buildings on the UMB campus.

24.2 Primary Service:

A. Four (4) 13.2 kV BGE feeders serve a University of Maryland closed ring bus commonly referred to as the North Electric Station (MSS) in West Saratoga Street. The MSS has twenty four (24) circuit breakers to provide a 13.2 kV distribution network throughout the campus. Buildings are typically served by two UMB feeders originating from opposite ends of the ring. Smaller facilities may have a secondary (480V or 208V) service from a larger UMB building or directly from BGE where UMB service is not economical. Conduct an evaluation and provide a report with recommendations at the schematic design phase submission. Where new buildings are added to the University's primary feeders, or a substantial change to an existing structure is made, submit a calculation at the Design Development Phase showing the existing load on the feeder, new load, and feeder capacity.

24.3 Grounding Requirements:

A. Structural Steel vs. Poured Concrete Structures and Grounding Electrodes: Per NEC 250, the grounded conductor of all separately derived systems must connect to the nearest grounding electrode via a conductor that is separate from the equipment grounding conductor of the primary service. For structural steel buildings, either a common grounding electrode riser or the building's structural steel can be used as the grounding electrode. For poured-concrete buildings, only the common grounding electrode riser can be used. As per NEC 250, interior water service piping located more than five (5) feet from the service entrance cannot be used as the grounding electrode. It is UMB's preference to always provide a minimum # 3/0 awg grounding electrode riser in the stacked electric closets to ensure a continuous, low-resistance pathway to earth that does not rely on building steel or concrete foundations.

B. Ground Grid Considerations: Incorporate the following in the building's underground ground grid:

1. Provide a minimum of six (6) 3/4 inch x 10 foot long copperweld ground rods spaced a minimum twenty (20) feet apart. Keep in mind that ground resistance decreases with the quantity of ground rods and as their spacing increases (ref. IAEI Soares' Book on Grounding).
2. Interconnect all ground rods using multiple pathways (i.e., not just a single daisy-chain run around the perimeter) with minimum # 4/0 awg copper and only Cad-Weld type welded connections. The available fault current from BGE is around 20kA. At 20kA, mechanical connections do not have the temperature rating for use with the # 4/0 awg wire (ref. IEEE Standard 80).
3. Provide direct, independent connections from the 15kV disconnects' ground bus, 600V switchboard ground bus, substation transformer equipment ground, the building's main substation ground bus, tel/data BDF ground bus, emergency

equipment room ground bus (if applicable), structural steel UFER ground (if applicable) to the underground ground grid via XHHW insulated, minimum 250kCM copper in two (2) inch PVC 40 conduit and waterproof sleeves. For the main substation ground, provide parallel connections to separate points in the grid for redundancy.

C. Lightning Protection Systems: As per NFPA 780, the grounding electrodes associated with a lightning protection system cannot be used in lieu of providing the substation grounding electrode system. Although permitted, it is not UMB's preference to interconnect the two (2) grounds in earth given the potential for stray voltages to propagate onto sensitive low-voltage systems.

24.4 Raceways, Cable Trays, Underground Ducts, Manholes And Handholes:

A. Galvanized steel electrical metallic tubing (EMT) up to four (4) inches in diameter shall be used for feeders, communication cables and branch circuits unless:

1. The NEC requires intermediate (IMC) or rigid galvanized steel conduits (RGSC) because of voltage class; or,
2. There is a risk of physical damage to the feeder and IMC or RSGC is appropriate.
3. Aluminum conduit shall not be used.

B. Intermediate (IMC) or rigid (RGSC) galvanized steel conduit shall be used for raceways over four (4) inches in diameter.

C. PVC Schedule 40 conduit, fiberglass strut, and NEMA 4X non-metallic junction and pull boxes and conduits shall be used outside buildings, on roofs, in garages (above eight (8) feet) or underground encased in concrete. PVC shall be used with approved expansion fittings in accordance with the manufacturer's recommendations, with a minimum of one fitting between every two fixed points and one fitting for every building joint that is crossed. All Boxes and raceway supports for PVC runs shall be PVC NEMA 4X non-metallic enclosures and fiberglass strut. PVC shall not be used inside HVAC-conditioned spaces.

D. Conduit shall not be exposed on the exterior of buildings. Conduit shall not be installed embedded in floor slabs or under slabs below grade unless required by code or expressly permitted by UMB.

E. Rigid steel conduit with bonded PVC coating shall be used outdoors, in garages, or in damp/ wet locations where potentially subject to physical damage; i.e., exposed vertical runs below eight (8) feet in garages or any location where it could be struck by a vehicle.

F. Size conduits in accordance with the NEC.

G. Branch Circuit Conduit Sizing: For research building projects, all branch circuit conduits shall be a minimum one (1) inch with no more than six (6) current carrying conductors per conduit. The neutral wire is considered a current-carrying conductor. For office buildings, housing projects, parking garages, and any other non-research space where a high amount of changes are not expected over the life of the space, branch circuit conduit shall be a minimum three quarter (3/4) inch.

H. Cable tray (center ladder type with nine (9) inch rung spacing) is preferred for vertical and horizontal telecommunications data, and signal cabling.

I. The entrance of cable trays into electrical/telephone rooms or through other fire rated construction shall be via approved fittings designed to use removable pillow type fire stops.

J. Conduits for the campus standard combination telephone and data communications outlets shall be a single one (1) inch EMT conduit extending from one (1), four (4) inch square box to above the lay-in ceiling or to the local distribution backboard if gypsum ceilings are used. Provide bushings with pull strings at both ends of conduits.
K. Provide a pull line, with two hundred (200) pound minimum tensile strength, in each data/telephone conduit and cable trays.
L. All branch circuits for power, telephone, communications, fire alarm, etc. shall be distributed from the same floor which they serve. On each floor, provide disconnects from the main power risers to each distribution panel.

    1. Example: An electrical panel located on the 3rd floor shall serve only the 3rd floor.

M. Romex cables shall not be used.
N. Manholes and handholes, both on state property and in the city rights-of-way shall be precast concrete to meet all requirements of Baltimore City DPW.
O. All new ductbanks shall be minimum five (5) inch PVC 40 encased in concrete with only long-sweep sixty (60) degree bends. Forty five (45) degree short bends are not permitted. The concrete structure shall be continuous with reinforcing. Top of the ductbank shall be minimum of twenty (24) inches below finished grade. The ductbank shall slope to drain to prevent accumulation of water and shall not have any low points. A utility marker tape shall be buried twelve (12) inches above each ductbank.
P. On projects which allow the use of the MC cable for value engineering efforts, MC cable shall be provided with interlocking steel armor for branch circuit wiring.
Q. MC cable shall not be used within the electrical rooms, mechanical rooms, janitor's closets, any exposed locations or those typical of RGS applications.
R. MC cable shall not be used for feeders. All homeruns shall go to a junction box and/or wire trough, located in the corridor ceiling space, immediately outside the electrical closet in EMT.

24.5 Wire And Cable, Busduct, Power Cable:

A. All cable shall have copper conductors. All busduct shall have insulated copper conductors. Aluminum conductors are not permitted.

    1. 15 kV cable for primary distribution shall be EPR 133% insulated, single conductor cable, rated for grounded system application. The size shall be determined by:
    2. Size of existing cables if a tap is to be made.
    3. Available duct or conduit size as determined by field survey.
    4. In addition, a separate ground cable shall be installed with the three single conductor cables, sized to protect the 15 kV cable shield in the event of a ground fault.
    5. Modular splice kits are allowed as needed and must be approved by UMB.

B. For 600 volt and under conductors, splices shall be as follows:

    1. #12 & #10, solid conductors: wire nuts.
    2. #8 and larger conductors shall be by compression type fittings using hydraulic crimpers.

C. Not more than one circuit supplied from the same phase shall be installed in the same conduit. No more than six (6) current carrying conductors per branch circuit conduit is permitted. The neutral wire is considered a current carrying conductor.

D. Existing 15kV cable which is to be spliced, capped, terminated, or otherwise cut, shall be tested per IEEE 400, Table 5, to establish its condition before performing any work and again before energizing. Similarly, new cable shall be tested according to the IEEE 400 recommendations before splicing, capping, or terminating and then again before energization. See UMB Master Specifications for additional requirements.

24.6 Electrical Identification:

A. This part defines the general requirements for electrical identification. When working in existing facilities and the existing identification systems are found to vary from the following requirements, bring any differences to the attention of UMB for direction.
B. Power feeders shall be identified in accordance with a scheme which relates the voltage of the feeder and the source of the feeder as well as number of that feeder.
    1. Example: 480V-1-5 which would indicate a 480V feeder from switchboard number one (1) which is designated “Number five (5) feeder”.
    2. The identification scheme should be tailored to the distribution system and may be simple for a building with one switchboard but must be appropriately sophisticated for a building with emergency and normal systems along with varieties of configurations and numbers of substations. Consult with UMB for final approval of identification scheme.
C. Substation and switchboard identification shall match with power feeder identification.
D. The panelboard name must identify whether it is on emergency power; what type of load is served; the internal buss voltage; the building floor being served; and a sequential number or address.
    1. Example: Panel ‘ELP232’ is an emergency lighting panel serving 208V/120 loads on the 3rd floor.
    2. Legend: Use the following legend in developing the building’s panelboard naming scheme:
        a. ‘E’: First letter to be included if on emergency power; leave blank if not on emergency power.
        b. ‘LP’: Lighting Panel
        c. ‘RP’: Receptacle and small loads panel.
        d. ‘LAB’: Emergency panel dedicated to a lab module or suite. Where ‘LAB’ is used there is no need to include the letter ‘E’ to identify emergency. These are normally fed from the ‘ATS-LAB’ emergency power riser in the building.
        e. ‘ELAB’: Emergency panel dedicated to a lab module or suite. Newer buildings may use ELAB labels. These may be fed from either a ‘ATS-LAB’ power riser or other standby electrical power source.
        f. ‘EQ’: Emergency Equipment Panel. Mechanical Division Loads, pumps, fans, ATC, fume hoods, etc. on emergency power that must stay in service during a loss of power. These are normally fed from the ‘ATS-EQ’ emergency power riser in the building.
        g. Emergency Distribution Panel (EDP): Typically used for the distribution panel in the electric closet on each floor that subfeeds the local ‘LAB’ panels in the research space areas.
        h. First Number in Series: ‘2’ designates 208V/120; ‘4’ designates 480V/277.
        i. Second Number in Series: Identifies which Floor the Panel is located on.

j. Third Number in Series: Assign a sequential number regardless of whether there is only one type/purpose or more than one. When working within an existing building, pick up the numbering sequence from the last existing panel.

E. Power system identification shall be shown on all risers, plans, and substation details and schedules.
F. Identify all equipment and low-voltage feeders with phenolic tags with white backgrounds and black lettering. Identify high-voltage feeders with phenolic tags with red background and white lettering. Attach tags to switchboards and equipment enclosures via self-tapping screws or rivets; attach to low and high-voltage cabling via weather-resistant plastic tie wraps. 13.2 kV panels shall be identified with phenolic tags with red backgrounds and white lettering.
G. Data and telecommunications riser cabling and backboards shall be identified using principles similar to those described for power. All cables and backboards shall be identified on each floor and the drawing riser diagrams shall be labeled to match.
H. The panel directories of all panels which are affected by this work shall be brought up-to-date with every circuit, new and existing, identified correctly. The directory shall be updated in UMB formatted spreadsheet. UMB shall provide spreadsheet file to A/E and Contractor, which shall be returned as part of the as-built documents to UMB.
I. Each circuit breaker shall be numbered and marked with proper markers in the spaces made available by the manufacturer of the panelboard. Panel schedule shall be in approved UMB format. Contact UMB for spreadsheet templates.
J. Each receptacle shall be neatly marked on the face of the cover plate with a printed label identifying the panel and breaker from which it is fed.
K. Where the receptacles cannot have a label on the face of the cover plate due to architectural reasons in public areas, receptacles shall be neatly marked on the inside of the cover plate with indelible marker identifying the panel and breaker from which it is fed.
L. All panels, safety switches, motor controls, switchboards/gear, etc., shall be correctly identified as to the feeder, motor or circuit controlled with white, black phenolic nameplates with minimum 1/2 inch high etched black letters and beveled white trim.
M. Emergency power outlets and their cover plates shall be red in color. Any special outlets that are not available in red shall be equipped with red cover plates.
N. Color code insulated grounding conductors in accordance with NEC 210.
O. Color code current carrying conductors (except control and instrumentation conductors) as follows:

1. 208/120 Volt System:

a. Phase A: Black
b. Phase B: Red
c. Phase C: Blue
d. Neutral: White
e. Ground: Green
f. 480/277 Volt System:
g. Phase A: Brown
h. Phase B: Orange
i. Phase C: Yellow
j. Neutral: Grey

k. Ground: Green

2. No. 12 thru No. 6 conductors shall have continuous insulation color.
3. Color code conductors larger than No. 6 which do not have continuous insulation color by application of at least six inches of colored tape on each conductor at all points of access including junction boxes.

P. Number code all control and instrumentation wiring at all points of access including junction boxes.
Q. Identify all circuits, branch, or feeder at junction boxes. This may be done by labeling the conduits entering the box where exposed.
R. Identify systems wiring by painting each junction box using the following schedule:

1. Fire Alarm: Red
2. Emergency: Orange
3. Telecommunications: Green
4. Security: White

24.7 Variable Frequency Drives:

A. General: Provide complete variable frequency drive (VFD) units of capacity, quantity and characteristics for fan and pump applications in a single enclosure, and suitable for use with both standard and high efficiency three (3) phase motors as follows:

1. For motors above 175hp, specify twelve (12) pulse or greater units for each motor. Each unit shall be of the same manufacturer. Smaller six (6) pulse not permitted for the larger hp motors.
2. For motors 175 hp and smaller specify six (6) pulse units for each motor. Each unit shall be of the same manufacturer.
3. Coordinate the size of drive with the equipment manufacturer.

B. Standards: All VFD's shall comply with the latest applicable standards of ANSI, IEEE and NEMA. As a minimum, the full load output current of the drive shall be equal to the equivalent motor horsepower as listed by NEC Table 430.
C. Acceptable Manufacturers: Subject to compliance with ANSI, IEEE and NEMA requirements, and unless otherwise indicated, all VFD's shall be products manufactured by one (1) of the following:

1. Siemens Technology,
2. Eaton Electrical Inc.
3. Square D.
4. Danfoss
5. Yaskawa

D. VFD Design: All VFD's shall be of the pulse width modulated (PWM) design converting the fixed utility voltage and frequency to a variable voltage and frequency output via a two (2) step operation. VFDs utilizing a 3rd power section are not acceptable. Efficiency shall exceed 96% at 100% speed and load. Line side displacement power factor shall exceed (0.95) regardless of speed and load. The VFD shall be rated for 110% current for one (1) minute for variable torque loads and 150% current for one (1) minute for constant torque loads.

E. VFD Enclosure Requirements: Each drive, including its accessories, shall be mounted in a single cabinet. VFDs shall be designed to be installed indoors unless it is not possible. VFD enclosures shall be suitable for both indoor and outdoor applications as follows:

1. Indoor Applications: Provide single NEMA 12 metal enclosure, including transformer, line filters, line reactor, PWM, etc., with manufacturer's optional exhaust fan package that does not require an air filter. Provide additional cooling and/or exhaust as required to ensure enclosure ambient temperature satisfies manufacturer requirements. Assume a room ambient temperature of 1040F (400C).
2. Outdoor Applications: VFD's located outdoors on rooftops, in parking garages, at grade, etc.: Provide a single non-metallic NEMA 4X enclosure and an independent heating and cooling system to maintain manufacturer's ambient operating conditions.

F. Drawing Requirements: The following information shall be included in the construction documents:

1. Incorporate the University's standard VFD specifications and details into project contract documents.
2. All design work shall be coordinated between electrical, mechanical and UMB.
3. Show VFD locations on mechanical plans. Ensure adequate mounting space and floor area including service access. VFD preferred location is adjacent to and within the same room as equipment served.
4. The 50% Contract Document review submission shall include specifications and details for VFD's.
5. For projects where the VFD load exceeds 0.1% of the forecasted building load then the 50% Contract Document review submission shall include harmonic calculations made in accordance with IEEE 519 Standards showing the specified THVD, line notching and the specified THCD limits are met. Calculations shall assume worst case system conditions. The review submission shall include, as a minimum, the following information:

    a. All input data and assumptions.
    b. Explanation of method used to perform the analysis
    c. All calculations and computer printouts used in the analysis, including input documentation.
    d. A system impedance diagram based on the electrical one-line diagrams.
    e. All calculations shall be in accordance with IEEE 519 with all drives at 100% speed. The point of common coupling shall be the secondary connection of the transformer supplying that group of devices. These calculations shall be done with the transformer loaded to no more than 70% of its nominal capacity. These calculations shall also be done with all twelve (12) pulse or greater drives running as well as the smaller drives running.

24.8 Service Entrances And Substations (Medium Voltage):

A. Primary electrical service is available from the University 13.2 kV distribution system.
B. Available fault current at the master switching station (MSS) bus is 19,200A/500 MVA phase to phase and 18,900A/500 MVA phase to ground at 13.2 kV.

1. The UMB 13.2 kV distribution system shall be used unless use of the BGE distribution system has been specifically allowed by UMB.

C. Typical primary service is via two feeders, two air load interrupter switches and one fuse compartment. The fuse compartment is key interlocked so that both switches must be open in order to gain access to the fuses.
D. 100% spare fuses are required.
E. Typically, two transformers with a secondary tie breaker are used, although UMB may elect to serve garages and small office or academic buildings with a primary selective (dual feeder) single-ended substation. Automatic transfer may be required as directed by UMB depending on the reliability designated
F. Voltage surge protection shall be applied in the primary switches.
G. B.I.L. rating is 95 kV.
H. All bus and coils shall be copper.
I. The whole substation assembly shall be on a housekeeping concrete pad at least four (4) inches above the room floor.
J. The following items shall be furnished with each substation:

1. Hotstick with voltage tester
2. Two (2) sets of three-phase grounding clamps and associated "welding cable" to permit grounding of primary switches; and
3. One line riser diagram of the complete electrical system framed and covered in plexiglass.
4. A gang box style storage cabinet for tools and equipment.
5. Remote racking mechanism.

K. Water piping and drain piping shall not be permitted in substations and or electric rooms. The only exception to this requirement will be the piping required for the fire protection system.

24.9 Switchboards And Switchgear (Low Voltage):

A. Double-ended substations are to be employed, the mains and ties shall be metal enclosed, draw-out air, or draw-out insulated case circuit breakers with automatic throw over and manual operation, depending on the application.
B. Feeder circuit breakers shall be draw out type and shall either be molded case, or insulated case depending on application. Microprocessor based trip units shall be used in all switchgear.
C. Copper bus is standard.
D. Feeder lugs shall be copper and UL approved and meet the temperature rating for the feeder served.
E. All spaces in the switchgear or switchboard shall be occupied with a circuit breaker. Circuit breakers not serving a load shall be provided with variable and adjustable rating trip devices.
F. All circuit breaker trip devices shall be coordinated.
G. All circuit breaker trip devices shall be set, in accordance with the coordination study, by the contractor before placing the feeder in service.
H. Circuit breaker trip operation shall be tested and adjusted as required to comply with the coordination study by an independent electrical testing company.
I. Computer/laboratory power should be separated from mechanical and lighting systems where possible.

J. Service entrance main switchgear shall have transient voltage surge suppression installed.
K. All switchgear shall be ANSI/IEEE type 2 arc resistant.
L. All associated metering equipment shall be installed in an isolated separate compartment to facilitate service while gear is energized including shorting blocks, disconnect for meter power, etc. Fused disconnect used only for voltage inputs to meter equipment only.
M. Provide copies of all PLC Programs on a thumb drive and paper copies for each station. Provide PLC program software.
N. Install a laminated copy of Switchgear Sequence of Operations including Instructions on how to Operate Gear on front of gear.

24.10 Electrical Metering:

A. Square D metering equipment is the UMB standard for the following applications:

1. Building Service Entrance and/or Switchboard/gear Main Circuit Breakers
2. Building Sub-metering for Separating Self-support Occupancy Loads
3. Generator Alarm and Fuel and Auto-Transfer Switch Status Monitoring: Tie the genset "common alarm," "running," and "low fuel" alarm outputs; Main fuel and genset day tank's "high level," "low level," and digital fuel monitor's 4-20mA analog outputs; and the auto-transfer switch's "emergency mode" and "normal mode" switch status outputs to the UMB electrical metering system via the meters described above.
4. Metering EP Circuit: Put all electrical metering equipment control power inputs on a dedicated 120V emergency power circuit derived from the 'Life Safety' emergency power riser in the building (i.e. Do not use the 'LAB' or 'EQ' Risers). Do not simply tap the 'A' phase PT input terminal. Backup the 120V emergency power circuit with a 750VA UPS with "low battery" and "replace battery" contact outputs that are tied to a local meter with I/O capability. Provide a shelf for the UPS with a pad lockable strap to keep the UPS secure. Recommended vendor and part information is the APC Smart-UPS 750VA USB & Serial 120V UPS with a relay I/O smart slot card (APC Part # SUA750 with Part #AP9610). In addition to the UPS, provide a Liebert 120V power distribution unit, rack-mountable, and with bypass switch (Liebert part # 2U POD). Verify model number or equivalent with UMB.
5. 3 Phase 4 Wire (3P4W) Applications: For 3P4W applications, provide four (4) CT's and three (3) PT's. For 3 Phase 3 Wire (3P3W) applications, provide three (3) CT's and two (2) PT's. Do not provide two (2) CT and three (3) PT installations for 3P3W. Both CT and PTs shall be 0.3% revenue metering class accurate with CT's also having a 133% rating factor.
6. High Voltage Applications: For high-voltage applications, do not 'piggy-back' the electrical metering onto the same CT's used for the overcurrent relays. Relaying CTs come with a higher rating factor (i.e., to avoid saturation problems during fault conditions) which degrades their accuracy performance to +/- 10% even with a light burden on their secondary circuit. Provide dedicated CTs for the metering that are revenue metering class accurate.
7. Blocks and Fuses: Provide CT shorting blocks and PT fuse blocks for each installation.

8. Technical Support: Through Square D, provide two (2) years of powerlogic technical support for the UMB electrical metering system.

B. For each new building project, provide a dedicated ethernet switch (consult UMB for latest part number information), backup UPS with battery alarm contact output connected to either the building automation and/or electrical monitoring system, and a bypass switch.

1. Rack Mount Installations: For rack mount installations specify an APC smart UPS 750VA USB & serial 120V (part #SUA750RM1U) with an APC smart slot triple chassis (part #AP9604), APC network management card (part #AP9616), and an APC relay I/O smart slot card (part #AP9610). Connect the "replace battery" contact output from the smart slot card to the local building automation system panel and connect the network management card to the local ethernet switch. In addition to the UPS and expansion chassis, provide a Liebert 120V power distribution unit, rack-mountable, and with bypass switch (Liebert part # Micro POD MP2-115A). Verify part numbers with UMB.
2. Metering Network Switch: For the metering network switch specify a Cisco switch, part number WS-2960-24PC-L. Verify part numbers with UMB.

C. If required, additional metering system modules shall be included with the building construction scope of work to accept the metering input.

24.11 Transformers:

A. 13.2 kV primary transformers shall generally be 1150C temperature rise ventilated dry, cast-coil type with copper coil and of the appropriate voltage secondary. For single-ended substations provide liquid-filled transformer with an insulator that has a high fire-point rating for indoor applications and containment wall/curb for greater reliability and overload capacity.

B. Characteristics & Features:

1. Hot spot temperature gauge with output for remote monitoring.
2. 5.75% impedance 7.5% tolerance
3. 95 kV B.I.L. primary; 10kV B.I.L. secondary
4. NEMA standard sound level; and,
5. Two 2-1/2% taps above rated voltage and two 2-1/2% taps below rated voltage.
6. Provide forced air cooling.
7. Provide transformer temperature monitor for remote recording of transformer winding temperatures.

C. Primary and distribution transformers shall be grounded to the building's substation grid in addition to any NEC requirements.

D. 600V Class Transformers' Energy Efficiency Standards – Shall comply with NEMA TP-1

24.12 Panelboards:

A. All new panel boards for power distribution, lighting, and branch circuits shall use bolt-on circuit breaker protective devices. Fused switches shall not be used. Plug-in circuit breakers may be used only when connecting to existing panels that accept only plug-in breakers.

B. Provide additional spare conduits from flush mounted panels stubbed out above the lay-in ceiling for future use. The number of conduits should be half the number of one-pole spaces left for the future to maximum of six (6).
C. All panels installed in electrical rooms and mechanical rooms shall be surface mounted.
D. All panels shall be copper bus and breakers and shall be door in door enclosure type. Both the internal and outer doors must be hinged. Providing hinges for the outer cover is typically an optional item so it must be clearly stated.
E. All new branch panels shall be either forty two (42) pole or eighty four (84) pole with a min. 225 amp (208V) or 250amp (480V) bus rating. The potential savings by using a thirty (30) pole versus a forty two (42) pole panel is quickly lost after several small renovations and a new branch panel is required because a twenty four (24) pole or thirty (30) pole was previously specified. Also, the bus bars in most 100 amp or 150 amp panels are already 225 amp (i.e., 'NQOD') or 250 amp (i.e., 'NF'). Where special circumstances require the panel to be 100 amp or 150 amp, then require the panel to be "ready to be assembled" in the field instead of "factory assembled." When 100 amp or 150 amp panels are "factory assembled," the nameplate will reflect the engineer's required amperage when they are actually a derated 225 amp or 250 amp panel. In contrast, "ready to be assembled" panels will reflect the actual rating of the bus bars regardless of what the engineer required them to be. In addition, "ready to be assembled" panels have a much shorter lead time (1-2 weeks vs. 4-6 weeks) and are less expensive.
F. All new 'I-Line' type distribution panels shall have a minimum ninety nine (99) inches of breaker mounting space (i.e., the combined vertical mounting space on both left and right sides) and with the minimum breaker capacity or prepared spaces for installing 400A and/or 600A branch circuit breakers in the future. Distributors do not size these panels based upon required poles but on the required amount of breaker mounting space. They also may still provide the largest panel possible but then shorten the internal bus bars, so the extra mounting space is useless.

24.13 Emergency And Standby Electrical Power System:

A. Emergency Generator Permitting: Per MD COMAR Rule # 26.11.02.10 Part E, all new emergency generator installations with an output greater than or equal to 500 brake horsepower or 373 kW must first receive a 'permit to construct' from the Maryland Department of the Environment (MDE). However, prior to receiving MDE approval, the MD Public Service Commission (PSC) must issue a Certificate of Public Convenience and Necessity (CPCN) Exemption for the generator and, prior to the PSC issuing the CPCN waiver, BGE must provide a CPCN 'Relief Letter.' As soon as the design team is confident the generator size will exceed the MDE 373 kW limit, work with the designated UMB Representative to generate the above permit and CPCN waiver applications. For the BGE application, provide a one-line diagram of the building project's proposed emergency power distribution system that confirms the genset will comply with a MD PSC 'Type I' application meaning it will only be used during a loss of utility power and not 'Type II' where it could be used for paralleling with utility power.
B. Buildings shall have a source of emergency and standby electrical power, typically one (1) or more natural gas and/or diesel generator set(s). Where identified in the program, the EPS/SEPS may be used for electrical demand peak shaving or load curtailment. For small loads, UMB may elect to use a battery/inverter system. EPS/SEPS would be sized based on the following typical loads:

1. Emergency Power Loads:
    a. Life safety requirements including all fire alarm and fire protection (fire pump), emergency, exit and egress lighting loads, and ventilation loads as required by the authority having jurisdiction.
    b. Generator accessories including fuel pump, enclosure louver activators, ventilation, and miscellaneous controls.
    c. Security, access control, telephone, and data communications systems
    d. Electrical substation, generator room, Tela/Data BDF and IDF closet(s), and server equipment room(s) lighting and convenience power to facilitate quick restoration of normal power and voice/data communications.
    e. Elevator cab lights, control communication and signal systems.
2. ATC Panels.
3. Standby Electrical Power Loads:
    a. Fume hood exhaust where loss of exhaust could create a hazard.
    b. Elevators, typically through use of a sequencer so that only a single elevator runs at a time, with consideration for additional capacity for a service elevator.
    c. A generous amount of laboratory convenience and equipment power. In some critical medical research laboratories, up to 100% of convenience receptacles are connected to the SEPS. Equipment load may include freezers, centrifuges, walk-in cold rooms, etc.
    d. Other unique loads as required, i.e., data centers, NMR's, some server farms, etc.
    e. Reasonable growth and future expansion, typically 20% - 50%, according to facility. However, given the conservative inrush magnitudes and multipliers programmed into most genset vendors' sizing software and the end-user's high diversity factored in during planning there is usually plenty of spare capacity realized with building occupation and use.

C. In addition, generators must be sized using as a criteria motor starting with 15% maximum voltage drop at the motor.
D. The engine generator day tank shall have a sight glass or an electronic display to show fuel levels.
E. Where applicable, provide a double-wall, sub-base day tank for each genset.
F. Provide local fuel gauges for both the main fuel tank and genset day tank. In addition, provide digital fuel monitors for both the main fuel tank and genset day tank with a min. of two (2) 4-20mA signal outputs from each fuel monitor. Tie one (1) of the signal outputs from each of the tanks' digital fuel monitors to the UMB electrical metering system for remote recording of tank liquid levels. In addition, tie the 'high' and 'low' liquid level digital output alarms from the fuel tanks to the UMB electrical metering system. The other signal output will go to the local BAS/ATC monitoring panel.
G. All engine generator transfer switches and engine sensing devices for correct system operation shall have contacts for remote monitoring. The contacts shall be for common alarm, anticipatory high coolant temperature, and low oil pressure.
H. Additional alarm contacts shall be provided:
    1. Generator called on to start,
    2. Mode switch not in "Automatic",
    3. Over speed,

4. Over crank,
5. Battery alarm,
6. Transfer switch in emergency position,
7. Transfer switch in normal position,
8. Ventilation fan on/off,
9. Louver closed/open,
10. Fuel pump for day tank malfunction,
11. Engine heater not working.

I. The generator set shall be natural gas and/or diesel fueled with automatic start and transfer upon loss of normal power. Automatic transfer switches shall have manual by-pass switches to permit maintenance and repair of automatic switches without interrupting the load being served.
J. Each engine-generator set shall have a local start/stop switch at each unit.
K. Engine generator sets should be located close to the normal power switchboard as appropriate to permit paralleling with the normal power substation for demand peak-shaving and curtailing load operations. Provide a tie circuit breaker and tie feeder between the emergency power bus and the appropriate substation secondary.
L. The contractor shall fill and 'top off' all fuel tanks within forty eight (48) hours of final acceptance.
M. The emergency power system shall have a status monitoring system with annunciation at the building automation system (BAS). In addition, several summary alarms as well as fuel level indication will be transmitted to the campus BAS.

1. Example of parameters are as follows:

a. Common Alarm
b. Run Status
c. Mode switch in other than automatic
d. Coolant temperature
e. Oil pressure
f. Over speed
g. Over crank
h. Battery voltage status
i. ATS status
j. L.V. main circuit breaker status
k. Reverse power
l. Fail to synchronize
m. Engine running
n. Low fuel level
o. Ground fault

N. Bridge Power Distribution Systems: The A/E shall coordinate with UMB to determine whether the need exists for providing a bridge power riser and/or distribution system for supporting the following critical systems during the eight (8) to twelve (12) second source transfer from normal power to emergency power:

1. Tela/Data systems including network switches that support VOIP.
2. Building automation system network panels and all low-voltage power supplies.
3. Fire Alarm, access control, intrusion detection system panels.
4. Provide monitoring points connected to the BAS for:

a. Common Alarm
b. Bypass
c. Inverter On Load

5. The bridge power riser will consist of a separate distribution system fed off the standby emergency power service that ties into a central UPS via receptacles and/or disconnects. In sizing the UPS, consider 100% spare capacity with a run-time capability of only fifteen (15) minutes (the UPS will only need to run for a maximum of fifteen (15) seconds). Consider dedicating the riser to the stacked tel/data closets with branch circuit taps to the local floor's electric and/or 'energy management' closets for supporting the building management system loads.

24.14 Interior Lighting

A. General: Lighting levels shall be in accordance with I.E.S standards, IESNA (Illuminating Engineering Society of North America) Lighting Handbook latest edition; maintained levels.
B. All lighting fixtures shall be of LED light source type that are approved as "Efficient Lighting Systems". Review LED luminaires to evaluate glare control, flicker rates, and color rendering capabilities.
C. Building designs shall take maximum advantage of day lighting. Ambient light sensors, dimmers and programmable controllers are to be used where standards and codes require them. The type of photo sensors used shall be coordinated with the lighting control system.
D. To take the advantage of the day lighting, where applicable the lighting fixtures shall be placed perpendicular to the exterior window to achieve maximum control.
E. Where sufficient day lighting is achieved and requires to turn-off or reduce the overhead lighting level, task lighting shall be provided for supplemental lighting.
F. Automatic Lighting Control: Up to 60% of a building's lighting load is wasted or unused. As UMB becomes more aware of the potential energy savings through lighting control and the efficient use of lighting, the proper design of lighting control system(s) for a building becomes ever more important. The design of the lighting control system shall be in accordance with the latest IECC code and ASHRAE standards. In developing lighting control system(s) for a building, please incorporate the following: the buildings lighting control system shall include the following:

1. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.

   a. Monitoring: On-off status.
   b. Control: On-off operation.

2. Occupancy/ Vacancy Sensors: Provide sensors for all public spaces, lobby areas, corridors, vending areas, waiting rooms, bathrooms (ceiling-mounted only), etc. Vacancy sensors shall be used in offices, classrooms, and conference rooms. Classrooms and conference rooms may be integrated into the building lighting control system for more complicated occupancy requirements. The occupancy sensors shall be multi-technology type.
3. Central Lighting Control Panels: Centralized lighting control panels for interior lighting should be used for special purpose applications such as auditoriums,

theaters, seminar, and conference rooms where manual control of the lighting is critical to the successful use of the space.

4. Wireless Lighting Controls: If wireless technology systems are proposed, consult UMB for requirements of wireless lighting controls. Requirements will be dependent on building and location.
5. Electronic Timer Switches: Provide electronic timer switches in all utility rooms/spaces with a display that counts down the time remaining) and with a time frame of up to eight (8) hours. All timer switches in utilities rooms/spaces shall be equipped with an override, if timer switches with overrides are not available, manual on/off switches shall be used. Electronic Timer Switches shall not be installed in substations or electrical rooms. Manual on/off switches shall be installed in those spaces.
6. Safety Exceptions: Exceptions to these requirements may be taken where there is impact to safety or security of the space. Consult with UMB for specific requirements.
7. Preferred Manufacturers:

    a. Lutron
    b. Acuity Controls Light
    c. Siemens
    d. Leviton

G. Lighting Calculations: Perform all lighting calculations in accordance with the latest edition of IESNA Lighting Handbook. Submit hard copies and electronic files of the calculations to UMB for review and comment during design phase. Submissions shall include the following:

1. Calculations at a minimum shall include:

    a. Room name,
    b. Room number,
    c. Fixture type chosen for the room,
    d. Actual and delivered LED lumen outputs used,
    e. Color temperature (UMB Standard - 3500° K, minimum CRI of 80),
    f. Light loss factor,
    g. Required illumination level (IESNA),
    h. Calculated illumination level,
    i. Calculated illumination level statistics,
    j. Power density statistics,
    k. Lighting fixture schedule, and
    l. All light loss and reflectance assumptions used.

2. Calculations indicated shall be submitted as part of construction design documents.
3. Calculations for most interior spaces may be performed using the zonal cavity or point-by-point method. Perform and submit point-by-point calculations for areas of greater architectural or luminous complexity. Perform and submit point-by-point calculations for laboratory designs.
4. Calculations for exterior spaces, including parking structures, shall be point-by-point.

5. Calculations shall include demonstrated compliance with energy conservation measures. Allowed Lighting Power Density (LPD) figures shall follow ASHRAE 90.1.

H. Lighting Fixture Schedule: Provide a Lighting Fixture Schedule on the drawings, separate from the specifications.

1. The Lighting Fixture Schedule shall state at a minimum:

a. Fixture designations used on the plans,
b. Lighting fixture description,
c. LED lumen type,
d. LED driver type,
e. Wattage per fixture,
f. Three manufacturers and complete catalog numbers for each fixture
g. Voltage
h. Mounting type

2. For site lighting fixtures include catalog numbers for pole and mounting height.

I. Lighting Design: Lighting design includes the following:

1. Laboratory: See paragraph 16 for requirements.
2. Non Laboratory Areas: The A/E shall make recommendations applicable to specific project. UMB standard recommended fixtures for general lighting areas (2x4, 2x2, and 1x4) are as manufactured by H.E. Williams – AT1, Lithonia – BLT and Cooper Lighting Metalux – RD1.

J. Lighting Schemes: Provide at least two (2) proposed lighting schemes for special or architecturally unique areas such as: Lobbies, Atriums, Conference Rooms, and other special use areas identified in the project program or as directed by UMB. Layouts shall vary in design and materials such as fixture layout, fixture type, lamps, louvers, reflectors, etc. to enable UMB to select the best scheme to suit project goals and budget requirements.

K. Excluded Fixtures: Do not use fixtures with "wrap-around" lenses.

L. LED Lighting:

1. Provide LED luminaire as a complete luminaire consisting of housing, reflector/lens, LED module, driver and dimming driver. LED luminaires from different manufacturers which have similar housing, lumen output, input wattage, and optical system may have different photometric performance. A/E shall review all important performance parameters to assure a minimum of three domestic manufacturers are producing equivalent equipment.
2. Utilize LED luminaires when operating at or below temperatures of 32ºF. LED luminaires perform well in cold weather. Do not specify LED luminaires for environments that exceed 122ºF, unless LED luminaires are certified, listed and warranted by manufacturer for such environment. Verify with manufacturer that performance and warranty are not altered.
3. LED driver must be determined in conjunction with luminaire, lamp source, and controls. Utilize 0-10V dimmable power supplies as basis of design. LED power supplies must be field accessible.

M. Exit Signs: Exit signs shall be LED type with a uniform illumination of RED letters over the entire face.

1. UMB Standard Exit Sign Basis of Design: Lithonia EXR-LED-M6RAD

N. Battery Backup Fixtures: Battery Backup Fixtures shall be LED type. When battery backup fixtures are required; specify maintenance free type fixtures self-diagnostic test feature.

24.15 Exterior Lighting:

A. General: The University goals, for an attractive institutional identity within its urban setting, as well as a high priority for security and safety requires open spaces and the exterior of buildings be well-lighted. Except in locations where it may be necessary to relocate or remove, and approval of Baltimore City is obtained, the city street lighting grid utilizing a high pressure sodium (hps) or LED source on twenty four (24) foot or thirty (30) foot masts shall remain in place. This lighting shall be supplemented by University projects to raise the overall minimum on pedestrian walks to five (5) foot candles. Provide LED light source fixtures. Review LED luminaires to evaluate glare control, flicker rates, and color rendering capabilities.

B. Building and Site Lighting: Building and site lighting, including steps and ramps, shall be provided by each project. Entrances and service areas, such as loading docks, shall be provided with ten (10) foot candle lighting level. Alleys and incidental spaces such as interior courtyards, etc. shall be provided with a minimum of five (5) foot candles and a uniformity ratio of three (3) to one (1). Highlighting of architectural features may be recommended for major capital projects which have a significant impact on the campus setting and institutional identity. Landscape lighting has not been employed on campus but may be proposed for unusual conditions. In general, utilitarian direct source fixtures such as “wallpacks” should not be used on facades or areas facing the public streets. “Walpack’s” may be used in spaces outside direct public view such as alleys with agreement from UMB.

C. Sidewalk Lighting: Sidewalk lighting shall be provided as a private lighting system powered from the project. The standard fixtures are:

1. Type 1 Fixture: Pedestrian Walkway:

a. Model: Louis Poulsen Model # ALBEERTSLUND-MAX1-LD-GREY FINISH-ALB MAX PT/LED/120 277/GREY/T DRA 5.3”
b. Lamp/LED: CCT - 4000K, WATT- 82, LUMEN – 4996, LIGHT SOURCE 82WLED 4000K, GREY, INSULATION CLASS 1, EFFICACY 61. LED driver in fixture head.
c. Mast: Louis Poulsen #DRA-5”.3”, 10’-BR ALU (BRUSHED ALUMINUM)
d. Base: Cast aluminum cover w/ tamper proof screws.
e. Pedestal: Site cast air-entrained concrete, top 2” above finished sidewalk elevation with four (4) galvanized anchor bolts, engineered for wind and impact loading. Sidewalks are usually brick or paver type. Poulsen pole detail is available on the UMB website.

2. Type 2 Fixture: Surface Parking Lot:

a. Model: Beacon Viper VP-L series
b. LED Engine Watts – Provide as necessary to provide required illumination for the area/parking lighting
c. LED Color – 4000K
d. Voltage – UNV
e. Optics – Provide Optics to suite illumination requirements.

f. Provide house side shield options as required.
g. Provide Bird Deterrent
h. Provide with rectangular arm for round pole mount.
i. Fixture Finish – Metallic Titanium Textured
j. Pole – Round Straight Aluminum Beacon Smooth, 25', Metallic Titanium Textured finish. Pole shaft and thickness shall be determined per ASCE 7-05 wind map EPA Load Rating

3. Type 3 Fixture: Plaza Lighting:

a. Model: Selux Saturn Cutoff LED # SACL-1-LG4700 (700Ma/65W)-40-8'-BRUSHED ALUMINUM -120 OR 277-DS-HS(AS REQUIRED)
b. Lamp/LED: CCT - 4000K, LG4700 (700mA/65W)
c. Pole: Round Straight Aluminum A35 -8' -BRA (BRUSHED ALUMINUM FINISH)
d. Base: Two-piece cast aluminum
e. Optics: Provide optics to suite illumination requirements

4. Exterior Lighting Control: Control all exterior lighting via the local building automation system through a mechanically held latching type lighting contactor with a mechanical override switch.

D. Exterior Lighting Calculations: Perform all lighting calculations in accordance with the latest edition of IESNA Lighting Handbook. Submit electronic files of the calculations to UMB for review and comment during design phase. Submissions shall include the following:

1. Calculations at a minimum shall include:

a. Site plan
b. Fixture type chosen for the site
c. Number and type of lamps to be used
d. Locations and mounting heights
e. Required illumination level (IESNA)
f. Calculated illumination level
g. Calculated illumination level statistics
h. Power density statistics
i. Lighting fixture schedule
j. All light loss
k. Reflectance assumptions used

2. Calculations indicated and submitted as part of construction documents are also accepted.
3. Calculations for exterior area lighting, side walk lighting; parking lot lighting and parking structure lighting shall be point-by-point method.
4. Calculations shall include demonstrated compliance with energy conservation measures. Allowed Lighting Power Density (LPD) figures shall follow ASHRAE 90.1 or IECC.

E. Lighting Fixture Schedule: Provide a Lighting Fixture Schedule on the drawings, separate from the specifications. The Lighting Fixture Schedule shall state at a minimum:

1. Fixture designations used on the plans,
2. Lighting fixture description,

3. LED lumen type,
4. LED driver type,
5. Wattage per fixture,
6. Three manufacturers and complete catalog numbers for each fixture
7. Voltage
8. Mounting type

24.16 Laboratory electrical design for new and/or renovation projects:

A. Design Intent: The intent of the laboratory electrical design is to standardize the use of materials, equipment, and systems for all new laboratory installations and all laboratory renovation projects. The A/E shall discuss with UMB the selection of all material and equipment prior to proceeding with the design.

B. General Laboratory Requirements: Standard laboratory requirements shall include but not be limited to the following:

1. Electrical Services: Electrical services shall include normal power, emergency power, and standby emergency power for laboratory equipment and lighting for each laboratory space.
2. Emergency Power Outlets: Red with red face plates with circuit number indicated on the back of the cover plate and on the face plate.
3. GFCI Outlet: GFCI and indicator within six (6) feet of wet areas.
4. General Lighting: Unless otherwise directed by UMB, provide 1x4 LED source fixtures in laboratories located over the laboratory benches. Lighting shall be designed in accordance with IES standards, IESNA handbook, most recent edition. Wherever feasible, use natural light as the primary daytime light source. Review LED luminaires to evaluate glare control, flicker rates, and color rendering capabilities.

    a. Provide 1- foot x 4-floot recessed LED lighting fixture with acrylic lens, installed above the edge of the lab bench. UMB standard laboratory fixtures are:
    b. LED – Lithonia – BLT, H.E. Williams – AT1, Cooper Lighting Metalux – RD1.

5. Special Receptacles: Coordinate with UMB for special type of twist-lock receptacles or other type of special receptacle requirements in the laboratories and equipment spaces.

C. Special Laboratory Requirements: Special laboratory requirements shall include but not be limited to the following:

1. Biological Safety Level 2 (BSL-2) Laboratories: Ultra violet lighting shall be provided only as plug-in equipment with integral switch as directed. Provide warning sign. All fixtures shall be vermin proof.
2. Biological Safety Level 3 (BSL-3) Laboratories: A/E design team must coordinate the designs for biological safety level 3 areas with UMB.
3. Animal Biological Safety Level 3 (ABSL-3) Laboratories: A/E design team must coordinate the designs for animal biological safety level 3 areas with UMB.
4. Surgery Laboratories, Survival: In laboratories used for survival surgery, in addition to standard laboratory requirements provide a ceiling mounted surgery light fixture and explosion proof outlets. Also lighting fixtures shall be watertight and vermin proof, and switches and receptacles shall be watertight. Surgery lighting fixtures shall be structurally engineered for installation in each space.

5. Surgery Laboratories, Non - Survival: In laboratories used for non - survival surgery in addition to standard laboratory requirements provide a ceiling mounted or floor mounted surgery light fixture and explosion proof outlets. Also lighting fixtures shall be watertight and vermin proof, and switches and receptacles shall be watertight. Surgery lighting fixtures shall be structurally engineered for installation in each space.
6. Animal Holding Rooms: In rooms used to hold animals, all lighting fixtures shall be watertight and vermin proof, and switches and receptacles shall be watertight. Fixtures shall be rated for clean room application.
7. Photo Dark Rooms: In dark rooms provide traditional red filter work lighting with exterior warning light with interlocked switches for alternative general lighting. Consult with UMB for specific requirements.
8. Administrative Support Areas: In administrative support areas include standard power, data, and lighting.
9. Equipment Rooms: In equipment rooms include standard power, emergency power for equipment, and lighting.
10. Laboratories with Low Flow Chemical Fume Hoods: In laboratory areas with low flow chemical fume hoods, consult with UMB to determine requirements if flammable or explosive chemicals will be used. For normal use low flow chemical fume hoods, in addition to standard laboratory requirements provide power for the fume hood and emergency power for incubators and other equipment and data outlets as directed by UMB.
11. Laboratories with Existing Standard Chemical Fume Hoods: In laboratory areas where the existing standard chemical fume hoods are to be reused from another location, consult with UMB to determine requirements if flammable or explosive chemicals will be used. For normal use low flow chemical fume hoods, in addition to standard laboratory requirements provide power for the fume hood and emergency power for incubators and other equipment and data outlets as directed by UMB.
12. Laboratories without Chemical Fume Hoods: In laboratories without chemical fume hoods, in addition to standard laboratory requirements provide emergency power for incubators and other equipment and data outlets as directed by UMB.
13. Tissue Culture Laboratories: In tissue culture laboratories in addition to standard laboratory requirements, provide emergency power for incubators and other equipment and data outlets as directed by UMB.
14. Prosthetic Dental Laboratories: In prosthetic dental laboratories provide standard power, emergency power, data and lighting as directed by UMB.

End of Chapter

Chapter 25: Networking, Telecommunications & Audio Visual Systems Design

Amended 09-19-2022, See underlined text

25.1 Scope:

A. This part outlines the minimum requirements for the design procedures for networking, telecommunications, and audio visual systems for new buildings, and repair and alteration projects for existing buildings on the UMB campus.

25.2 Telecommunications:

A. General: The telecommunications system design shall be coordinated with UMB and the UMB Center for Information and Technology Services (CITS).
B. Telecommunications requirements at the University of Maryland, Baltimore continue to increase in variety and complexity. It is unlikely that this situation will change in the future. Voice, data, and video requirements will vary over time, and will be different for each department and function of the University, but the trend will be towards more and faster communications capabilities.
C. This telecommunications wiring is designed to meet the specific current needs of the University, and to permit growth and flexibility in the future. Data requirements include the need for different levels of Ethernet from 100BASE-T to 100GBASE-FX over unshielded twisted copper pairs, and Fiber.
D. Drawing Requirements: The following information shall be included in the construction documents:

1. Incorporate University's (CITS) Standards and details into project contract documents.
2. During the schematic design phase, consult with UMB and UMB CITS as to what type of system will be required.
3. The telecommunications rooms shall be stacked. Include a 1/4 inch scale plan indicating device/equipment and cable tray locations to ensure adequate mounting space and floor area including service access. Refer to the mechanical requirements for redundant cooling system requirements.
4. Refer to main telecommunications specifications for details on equipment rack, cable tray, grounding, and room design.

25.3 Audio/Visual:

A. General: The audio/video system design shall be coordinated with UMB, UMB Center for Information and Technology Services (CITS), and School or Department specific A/V personnel based on the project.
B. Audio/Video requirements at the University of Maryland, Baltimore continue to increase in variety and complexity. It is unlikely that this situation will change in the future. Audio/Video requirements will vary over time and will be different for each department and function of the University.
C. Drawing Requirements: The following information shall be included in the construction documents:

1. Incorporate University's (CITS) and School or Department standard specifications and requirements and details into project contract documents.
2. During the schematic design phase, consult with UMB and UMB CITS as to what type of system and equipment will be required.

3. The audio/visual rooms shall be of adequate size for the system components. Include a one quarter (1/4) inch scale plan indicating device/equipment location to ensure adequate mounting space and floor area including service access.

End of Chapter

Chapter 26: Fire Alarm, Safety, and Security Systems Design

Amended 09-15-2022, See underlined text

26.1 Scope

A. This part outlines the minimum requirements for the design procedures for the fire alarm, safety, and security systems, for new buildings, and repair and alteration projects for existing buildings on the UMB campus.

26.2 Fire Alarm System

A. The Authority Having Jurisdiction for fire safety at UMB is the UMB Fire Marshal in the Office of the Fire Marshal.
B. The University maintains a central fire alarm monitoring, and mass notification system with network monitoring stations at the following locations:

1. Pine Street Annex,
2. Environmental Health and Safety Building,
3. Pearl Street Garage Electronics Shop
4. Pearl Street Garage Work Control
5. 620 West Lexington Street

C. The Communications Officer on duty at the Pine Street Annex summons Baltimore City Fire Department in the event of a fire emergency.
D. The central fire alarm system network command centers are manufactured by Notifier. All individual buildings on the campus are connected through the campus fiber optic network thru the communications duct banks except for the Community Engagement Center on S. Poppleton Street.
E. All buildings on the campus have a dedicated fire alarm control panel. Campus standard fire alarm control panels are either Notifier Model NFS2-640 or NFS2-3030. Communications to the Network Command Center shall be through the campus fiber optic Class A fiber loop dedicated to fire alarm system only. All work for the existing buildings shall be coordinated with UMB and the UMB Fire Marshal.
F. All buildings are equipped with backup dialers. For work that involves the backup dialer system, contact the UMB Fire Marshal and UMB O&M for direction.
G. All new buildings, including off-campus buildings, shall be connected to the central campus fire alarm loop.
H. For all new buildings on the campus, provide a Notifier Model NFS2-3030 addressable fire alarm control panel with voice capability and mass notification. As directed by UMB, provide fiber optic cabling for interface connection to the Class A fiber loop. The fiber optic connection design shall maintain connectivity for the entire campus loop. The cables are typically routed in University-owned duct bank, though Baltimore city duct bank also has been used.
I. Provide distributed system architecture by employing transponder panels for each floor. The transponder panel will serve as the distribution point for dedicated signaling line circuits (SLC) and Notification Appliance Circuits (NAC) to each floor. Do not use centralized amplifier systems or local booster panels for the NAC's. Provide line isolation modules for each Class "A" SLC. Consult with UMB Facilities and Fire Marshal to confirm system architecture for new buildings and specific requirements for special isolation areas.

J. Regardless of building height, provide a voice evacuation system with public address and selective paging capability. Beacons and horn notification appliances are required in spaces with high ambient noise levels that need to be overcome.

K. High-Rise Building Fire Command Center (FCC) Requirements: For those buildings defined as being high-rise, in addition to the fire alarm control panel (FACP) and fire alarm graphic annunciator panel (GAP) provide the following monitoring and control panels in the FCC:

1. Smoke Control Panel: Provided and installed by the local building automation system vendor. The panel should depict the smoke control systems and stairwell pressurization systems in the building and the spaces they serve, along with their run status and an "on- off-auto" control switch for each piece of equipment.
2. HVAC Monitoring Panel: Provided and installed by the local building automation system vendor. The panel should depict the major heating, ventilating, and air conditioning (HVAC) systems in the building and the spaces they serve, along with their run status and an "auto-off" control switch (i.e., no hand position) for each HVAC system. This can be combined with the Smoke Control Panel.
3. Generator Status and Alarm Monitoring Panel: Provided by the building genset vendor.
4. Building Elevator System Status Panels: Provided by the building elevator system vendor. Panel should have selector switches for normal or generator power, fire recall, and recall to lobby.
5. Additional Panels: Panels designated for monitoring of the smoke dampers, fire curtain or shutter systems, or other related systems may be needed based on the project.
6. Knox Box: Provide a Knox-Box with hinged door to store building keys. Refer to UMB Master Specs for product number.

L. Fire Alarm Initiating Devices: With the exception of manual pull stations, all components of the fire alarm system shall be self-restoring type. Detectors shall not be single use type.

M. Smoke Detectors: Smoke detectors shall be photoelectric type

N. Heat Detectors: Heat detectors shall be specified based on anticipated temperatures in the space served.

~~O.~~ Building HVAC System Duct Smoke Detector Control via the Automatic Temperature Control (ATC) System: The following requirements apply to all building HVAC systems:

1. Provide duct smoke detectors as required by code. Do not provide redundant detectors at the unit itself if they are already being provided at the floor locations.
2. For each duct smoke detector, provide a remote LED indicator for quick identification of the detectors' location. Where duct detectors are not located in a mechanical room, mount the remote LED at six (6) inches to twelve (12) inches below the ceiling in the wall in the nearest room and visible from the floor level in an accessible space. For detectors located in rooftop HVAC system units, mount the remote LED indicator just inside the units' mantrap door for quick identification. Do not include the test switch option with the remote LED indicator unless directed otherwise by the UMB Fire Marshal.
3. The building's ATC system will coordinate the shutdown of an HVAC system and its associated smoke and fire dampers due to a duct smoke detector alarm from the

fire alarm systems (FAS). Do not perform any direct interconnection between the duct smoke detector's contact outputs and the HVAC system starter(s) and any of its smoke and fire dampers and damper actuators.

4. Provide a dedicated addressable relay for each HVAC system with duct smoke detectors regardless of the quantity of duct smoke detectors on the HVAC system. The output from the addressable relay will be used to represent a 'shutdown request' to the ATC system for the multiple duct smoke detectors on each HVAC system.
5. For each HVAC system, coordinate with the ATC contractor and locate the dedicated addressable relay next to the ATC network panel that will be used to receive a 'shutdown request' from the FAS due to a duct smoke detector alarm.
6. Buildings with multiple HVAC systems will require several dedicated addressable relays next to the ATC panel(s). Again, provide a dedicated addressable relay for each HVAC system with duct smoke detectors and locate them next to the ATC panel(s).
7. Label each HVAC system's addressable relay to identify the HVAC system number and the device address of the relay.
8. If the above requirements are properly met, when a duct smoke detector goes into alarm the following sequence of events should occur:

    a. The detector reports a 'supervisory' signal to the FAS which is relayed to the UMB central monitoring station as a 'supervisory' signal.
    b. The FAS will initiate a contact output from the addressable relay associated with the detector in alarm to the ATC system panel which in turn will execute shutting down the HVAC system and closing its associated smoke or fire dampers.

P. Building HVAC Systems Dedicated for Life Safety Purposes: The fire alarm system directly monitors and controls stairwell pressurization fans and smoke control systems. Provide the following:

    1. Provide a dedicated addressable relay for each fan motor. Using the addressable relay provide a control output to start and stop the fan motor and derive a status input from the starter for remote monitoring at the GAP and Smoke Control Panel.

Q. Fire Alarm Graphic Annunciator Display Requirements: Wall-mounted backlit panel indicating the varying floor plan layouts of the building. A typical plan can be used for those floors with identical layouts. The building graphic requirements are listed in the UMB Master Specifications.

R. The fire alarm system shall be designed and constructed to meet or exceed ADA requirements, including those for application of audible and visual signals. Audible and visual signal concerns should be addressed separately in the design, so that code requirements may be met efficiently and effectively. It is not acceptable to simply place a combination audible/visual signal everywhere a visual or audible signal is needed. In high ambient noise and/or difficult visibility areas such as mechanical rooms, high output signals such as horns, sirens and rotating beacons shall be considered.

S. All new fire alarm systems should be addressable with alarm and event history log, separate dot-matrix printer, and graphic annunciator. Alphanumeric displays must be provided at the control panel.

T. Locate all pull stations and notification appliances in compliance with applicable codes and standards.
U. All sprinkler valve supervisory switches should be connected to initiate a supervisory signal. All high-low pressure switches shall initiate a supervisory signal. All water flow detector and pressure switches should be connected to initiate an alarm signal.
V. Provide firefighter's emergency operation in elevators in accordance with ANSI, NFPA and Elevator Codes.
W. Alarm initiating devices shall recall all elevators to the main floor unless overridden by elevator lobby smoke detectors.
X. Smoke detectors shall not be used in elevator lobbies where ambient conditions will subject them to false alarms. Heat detectors can be used where ambient conditions do not permit smoke detector usage.
Y. Elevator machine room smoke and heat detectors shall initiate alarm signals to the fire alarm system.
Z. Install smoke and heat detectors in elevator pits or shafts as required by code.
AA. Roof Top Fire Alarm Devices: Regardless of building type and height, provide horn-based weatherproof notification appliances and weatherproof rotating beacon lights indicating appliances on the roof of the building, connected to the building fire alarm system. In accessible packaged mechanical roof-top units, provide voice-activated speakers and strobes in a weatherproof enclosure inside the packaged mechanical equipment. Consult with UMB and the UMB Fire Marshal for exact requirements on HVAC size threshold where this applies.

26.3 CCTV System

A. UMB's Office of Public Safety operates a centralized CCTV system for surveillance of the campus. Cameras on campus permit UMB Police Officers to view and record campus activity. Video transmission and camera control are accomplished over UMB's optical fiber cable network.
B. Consult with UMB Office of Public Safety for CCTV requirements for interior spaces.
C. Consult with UMB and the electrical engineer for the product information on CCTV cameras, controllers, monitors, interface connections etc. for the UMB central CCTV system.

    1. CCTV system components are being evaluated. Consultant shall request updated standards upon project initiation.

26.4 Access Control, Intrusion Detection, and Panic Alarm Systems:

A. University Building Entrance Security System: The complete security system of the project shall be clearly indicated in the contract documents, including a written description of the function and sequence of operation for each location, set of doors or secure area. The operation shall be as determined during design by the A/E, UMB Public Safety, Office of Facilities Management, and the user.
B. The A/E shall attend all necessary 'Security Design Meetings' with members of the University design committee regarding requirements and operation of the security system as requested.
C. The Office of Public Safety monitors and controls access to UMB facilities through the University card readers. Connections are made via hard wire twisted pair cabling only, i.e., no telephone lines.
D. Components of the building entrances security system shall include:

1. Consult the UMB assigned electrical engineer for product and manufacturer information on the required network panel, Card reader interface(s), card reader(s), contact condition monitors (CCM), etc. applicable for the project.
2. For fail safe operation, mechanical panic bars should be used as the release mechanism on exit doors and with an internal switch to shunt the door monitoring alarm. Motion detectors are not acceptable as a door release or alarm shunt. For emergency exit only applications, coordinate with UMB for prop alarms or other security notification requirements.
3. Door status switches or alarm contacts are connected to access control system.
4. All additional access control equipment shall be compatible with the existing system.

E. Panic Alarms: Panic alarms shall be integrated with the campus security system. Panic alarms shall be included in the security system design of the project and shall be clearly indicated in the contract documents, including a written description of the function and sequence of operation for each location. The operation shall be as determined during design by the A/E, UMB Public Safety, Office of Facilities Management, and the user.

F. Panic alarm components of the security system shall include:

1. Consult the UMB assigned electrical engineer for product and manufacturer information.
2. All panic alarm equipment shall be compatible with the existing security system.
3. Panic alarm systems may be either wired or wireless. A/E must consult with UMB for final equipment selection.
4. Building panic alarm controller must be hard wired to the communications link and on emergency power.

26.5 Intercom System

A. Building Intercom System: As directed by UMB, provide an intercom system to allow communication from outside the building when access is limited and someone inside the building must be notified of visitors. The operation shall be as determined during design by the A/E, UMB Public Safety, Office of Facilities Management, and the user.

B. This is separate from the building communication system associated with the fire alarm.

26.6 Campus Emergency Phones

A. Emergency phones are installed at strategic locations throughout the UMB Campus to provide quick and easy access to communication links to the UMB Campus Police Department.

B. The requirement for the type of phone, mounting type, and location(s) shall be coordinated with UMB and with the UMB Campus Police Department during all design phases of the project.

C. Depending on the project requirements, and unless otherwise directed by UMB, the A/E shall include at least one (1) phone in the design:

1. Emergency Phone:

a. Contact UMB for specific phone manufacturer and model number.

b. Specific mounting type, either Wall Mounted or Pedestal Mounted based on the location.
c. Provide one (1) inch EMT or Non-Metallic conduit (depending on site conditions) from phone to the Main Telecommunications Room with pull string for communications wiring.
d. Provide one (1) inch EMT or Non-Metallic conduit (depending on site conditions) from phone location to nearest electrical closet for 120-volt power connection. Obtain 120-volt power source from emergency panel board.

2. The design for the installation and location of the phones shall be coordinated with all disciplines.

End of Chapter

Chapter 27: Incorporation of University Contracts for Construction

Updated September 19, 2024

27.1 Incorporation of University Contracts for Construction:

A. Contract(s) for Construction: All contracts for construction will be advertised, negotiated, and executed by the University Office of Strategic Sourcing and Acquisition Services (SSAS) (Procurement) acting with the UMB Project Manager. OPS will furnish the A/E and builder(s) with the following information for incorporation into the construction documents and contract(s):

1. Office of Strategic Sourcing and Acquisition Services regulations and attachments for construction contract(s).
2. Sections 00700 University Standard General Conditions of the Construction Contract (University General Conditions) and 00800 Amendments to the General Conditions.
    a. All proposed amendments to the University General Conditions shall be reviewed by the A/E with D&C prior to inclusion in the Project Manual.
3. Section 00830 Prevailing Wage Scales as determined by the Maryland Bureau of Labor and Industry for projects anticipated to cost over $500,000.

B. Warranties: The University General Conditions require that the entire project, materials, and workmanship, be guaranteed for a minimum of two (2) years, beginning with the date of substantial completion. Extensions of the overall two-year period, such as required by partial occupancy, turn-over or early acceptance of particular operating systems, and longer required warrantee periods for specific material or equipment shall be noted in the applicable section of the technical specifications. Division 1 shall coordinate and list all warranties required in the trade and materials sections.

End of Chapter

Chapter 28: Electronic Files

Updated November 20, 2024

28.1 General Requirements

A. Scope:

1. This chapter of the electronic files outlines the minimum requirements for computer aided design (CAD) deliverable standards and establishes the protocol for the creation of new electronic drawing files by UMB design staff members, and architects, engineers, construction managers, contractors, etc. hired by UMB for campus design projects. In this chapter the term “contractor” refers to anyone who may create and submit files.

B. UMB Intent:

1. It is UMB’s intent to have the contractors use our archive drawing files as a base line electronic file for all renovation projects thereby linking the renovation projects to each buildings archive file.
2. All contractors shall use AutoCAD Software for projects at the university If applicable submit project electronic files in both the BIM Format and AutoCAD “dwg” file format.

C. Compliance With These Standards:

1. All electronic file submissions must comply with these CAD deliverable standards.
2. All electronic file submissions that are not in compliance with these standards will be returned to the contractor for corrections at no additional cost with in thirty (30) days of notification of non-compliance.

D. Accuracy:

1. Contractors are responsible for the accuracy of all CAD drawings delivered to UMB. For all drawing entities all lines meet at intersections, straight lines are straight, and blocks are inserted properly without overlap.

E. Ownership:

1. UMB, for itself and such others as it deems appropriate, will have unlimited rights to all information and materials developed under contract and furnished to UMB. This includes any documentation thereof, reports and listings, and all other items pertaining to the work and services. Unlimited rights under this contract are rights to use, duplicate, or disclose data and information, in whole or in part, in any manner and for any purpose whatsoever without compensations to or approval from the contractor. UMB will, at all reasonable times have the right to inspect the work and will have access to and the right to make copies of the above-mentioned items. All digital files, associated data, and other products generated under the contract shall become the property of UMB.

F. File Formats:

1. General: All files must be organized and labeled as outlined in these standards.
2. Drawing and BIM Files: AutoCAD Drawing Files shall be readable “DWG” files and be in compliance with latest international standard classification IFC. BIM drawing files shall be readable “RVT” files and be in compliance with latest international

standard classification IFC. Such that UMB and/or a contractor accesses the dwg/Revit files, they open without any errors, such as proxy, font substitution, xref resolution, etc., and the objects, layers, and other elements in the file remain intact.

3. Imported Images: Imported images included in DWG or RVT files shall be *.TIF, *.GIF, *.JPG, *. CALS, *.PDF or *.BMP as raster images attached as a xref or embedded file.

G. UMB Electronic Files: UMB Standard CAD Drawing Templates and Cover Sheets

1. Electronic Files: UMB has a library of electronic drawing files for the buildings on Campus. This electronic library includes archive drawing files, and space inventory files for most of the Buildings on Campus and a set template files with standard sheet sizes.
2. Space Assignment Files: UMB space assignment drawings are maintained by the Real Estate Planning and Space Management Department (REPSM) and include floor plans, square footages, room numbers and titles, etc. and are generally used for conveying occupancy information. For some campus buildings this file may be the only electronic file on record.
3. UMB Standard CAD Drawing Cover Sheets and Templates: Use UMB Cover Sheets and Templates.
4. Cover Sheet and Template (Drawing) Files: UMB Cover Sheets and Template Files shall be used for all UMB Projects. See UMB web site for files.

28.2 Project File Organization

A. Scope:

1. This part outlines the requirements for the organization of the Electronic Drawing Files for all UMB Projects.

B. File Types:

1. Electronic Files: UMB requires deliverables to include the following file types:

a. PDF Files: Comply with the following:

i. PDF files must include electronic bookmarks using UMB Bookmark standards.
ii. PDF Files shall be text-search-able while maintaining original document formatting.
iii. PDF Drawing Files shall use appropriate line weights and have legible symbols and text and shall be a single file containing all drawing files.

b. AutoCAD Files (DWG Format) and BIM/Revit Files: Each drawing sheet shall be submitted as an individual CAD or Revit file.

C. File Names:

1. AutoCAD and Revit Drawings File Names: Include sheet numbers and sheet titles only. See “UMB Standard Sheet Numbers and Sheet Titles on the UMB Design and Construction Web Site.
2. PDF File Names: PDF files names shall identify file content.

D. File Content:

1. Project Specifications: The final project specifications shall include all written revisions to the bid documents that resulted from addendums, change bulletins, RFI's, etc.
2. Project Studies, Reports, etc.: Include all fee proposals with the scope of work, studies, reports, mechanical, fire protection and electrical calculations generated for the project.
3. Project Related Spread Sheets: Include all spread sheet type documents generated for the project. These files should include hourly rates for fee proposals; cost estimate spread sheets, etc.
4. AutoCAD and Revit Drawing Files: The final project drawing flies shall include all written revisions to the bid documents that resulted from addendums, change bulletins, RFI's, contractor mark ups, etc.

E. AUTOCAD and REVIT Drawing File Assembly And Organization:

1. AutoCAD DWG Files: The AutoCAD drawing files shall include reference drawings (xrefs) and a sheet file. The contractor shall use the UMB Standard CAD Template Files for all cover sheets and borders.

    a. Reference Files (Xrefs): Xrefs help to organize drawing information, enhance coordination, and minimize redundant data. The xref path shall not include drives or directory designations and the xref is placed on layer G-ANNO-REFR and locked.
    b. All xrefs shall be inserted at into a sheet file as an attachment or overlay.

        i. Do not bind the xrefs to the sheet files.
        ii. UMB's title block shall be referenced into a sheet file in paper space. The text/ attributes shall be inserted as a separate entity from the title block.

    c. Sheet Files: The Sheet drawings shall contain all annotation, text, schedules, notes, drawing titles (in paper space) and dimensions (in model space).
    d. Purge the Drawings: Each drawing shall be free of unused blocks, dimensions styles, layers, line types, plot styles, text styles, etc.

F. UMB CAD Templates: The contractor shall use the UMB Standard CAD Templates for all projects. The templates include a Cover Sheet, Title Block and UMB Logo(s).

G. Layering: UMB has adopted the latest AIA CAD Layer Guidelines for layer naming only.

1. Layer Colors: All entities shall be assigned a color by layer.
2. Line-weights and line-types: All entities shall be assigned a line-weight and line-type by layer.

H. Text and Fonts: Use only True Type fonts.

1. Text used for drawing notation shall be a minimum of one eighth (1/8) inch high.
2. Text used as "Titles" shall be a minimum of one quarter (1/4) inch high.
3. Text width shall be set to one 1.00.
4. Text color shall be black.

I. Line Types and Line Weights: For distinguishing between various types of conditions, such as new from existing, existing to remain from existing to removed, MEP and from background floor plans use line types and suggested line weights as follows:

1. Floor Plans, Sections Elevations etc.: Continuous lines with line weight - 0.13mm to 0.15mm.
2. Architectural Backgrounds for MEP, FP, FA Plans etc.: Continuous lines with line weight - 0.13mm to 0.15mm.
3. Existing to Remain Conditions: Continuous lines with line weight - 0.25mm.
4. Existing Demolition Conditions: Dashed / Hidden lines with line weight - 0.25mm
5. New Conditions: Continuous lines with line weight - 0.50mm.
6. Column Grids: Center lines with line weight - 0.10mm.
7. Examples: See examples at the end of the chapter.

J. Units and Scale:

1. Units: specified Imperial units shall be the standard system of measurement used unless otherwise.
2. Scale: Architectural units shall be used for all floor plans, sections, and details with the exception of civil drawings. They shall use the engineering scale.

K. Plan Drawings: Create a separate sheet file for each drawing. Use sheet files to combine floor plans with non-plan information or multiple elevations. Do not combine several drawings such as elevations, sections, and details in one model file. When a floor plan is too large to fit on a single sheet at the desired scale; use viewports in separate sheet files to show portions of the floor. Do not create individual model files for portions of a floor.

L. Column Grids and Designations: Each discipline shall use the same column grids and designations as developed by the prime consultant. The column grids and designations shall be grayed out and remain visible in the background so as not to conflict with the work represented by the discipline.

1. Renovation Projects: When projects include renovations to existing buildings the column grids and designations shall match the existing structure.

M. Dimensioning: All dimensions shall update automatically when the distance they are measuring changes (associative dimensioning).

N. Drawing Limits: Do not set the limits any larger than necessary to accommodate the drawing. No entities shall be located outside the drawing limits.

O. Drawing Origin: Organize drawings in model space so that the lower left intersection of the outermost column lines that remain constant on most floors is placed at 0, 0, 0. In order to ensure proper insertion of xrefs and the stacking of floor plans, the origin point for an entire building must be consistent between model files. Once the origin is established, it cannot be changed. For sheet files, place the lower left corner of the sheet at 0, 0, 0.

P. Attributes: Attributes may be used to store data in the drawing. Do not use attributes to store large amounts of data (greater than 10% of drawing size) or types of data that are better stored in external databases. UMB requires the use of an attributed title block and a model file attributed block to store descriptive data about the drawings; see title blocks.

Q. Blocks: Any graphic entity that occurs repeatedly in drawings should be made into a block. Attributes contained within a block should pertain to the current project. Insertion points for each block shall be consistent with its placement in the drawing. Use logical insertion points such as the center of a circle, bottom left corner of an object, etc. Keep names simple and descriptive. Purge all unused blocks from the drawing. Nested blocks are permitted but should be avoided whenever possible. If nested blocks are used, they must be documented on the project and drawing documentation form (see Chapter 28: Electronic Files 28.3 Deliverable File Requirements). Draw objects used to create blocks on layer zero (0) so the block inherits the properties of the layer on which it is inserted. Do not insert blocks on layer zero (0). When drawing files are submitted no objects shall be placed on layer zero (0) unless otherwise specified.

R. Xrefs: Autodesk Architectural Desktop term for external reference. Xrefs help to organize drawing information, enhance coordination, and minimize redundant data. The xref path shall not include drives or directory designations and the xref is placed on layer G-ANNO-REFR and locked. Document the relationship between drawing file and xref on the project documentation report and deliverables matrix.

S. Graphic Standards: Drawing standards and symbols shall be in accordance with the AIA Architectural Graphic Standards. The U.S. National CAD Standard is also a good reference for drawing symbols, details, and guidelines.

T. Hatching: Do not use polylines with increased width for poché or hatching. All hatching shall be associative.

U. Key Plan: G-SITE is the layer on which the key site plan should be drawn.

V. Project Area Information: As part of the project electronic files, the A/E shall outline the project areas as follows:

1. Gross Square Footage: On layer A-Area-Space-GSF outline the perimeter of the project area with a continuous poly line to identify the project gross square footage.
2. Individual Square Footage: On layer A-Area outline each space in the project area with a continuous poly line to identify the square footage of each space. The individual spaces shall include all occupied spaces, storage areas, toilet rooms, stairwells, elevator shafts, janitor closets, mechanical and electrical rooms and shafts, corridors, and lobbies.

W. E Transmit: Use the E transmit command to combine all required associated files into a single “zip” file for each “dwg” file prior to forwarding the file to UMB. Associated files shall include external references, fonts, and plot styles for each file.

28.3 Line Weight Examples

A. Examples Example taken from UMB project 22-319 Howard Hall 1 - GPILS

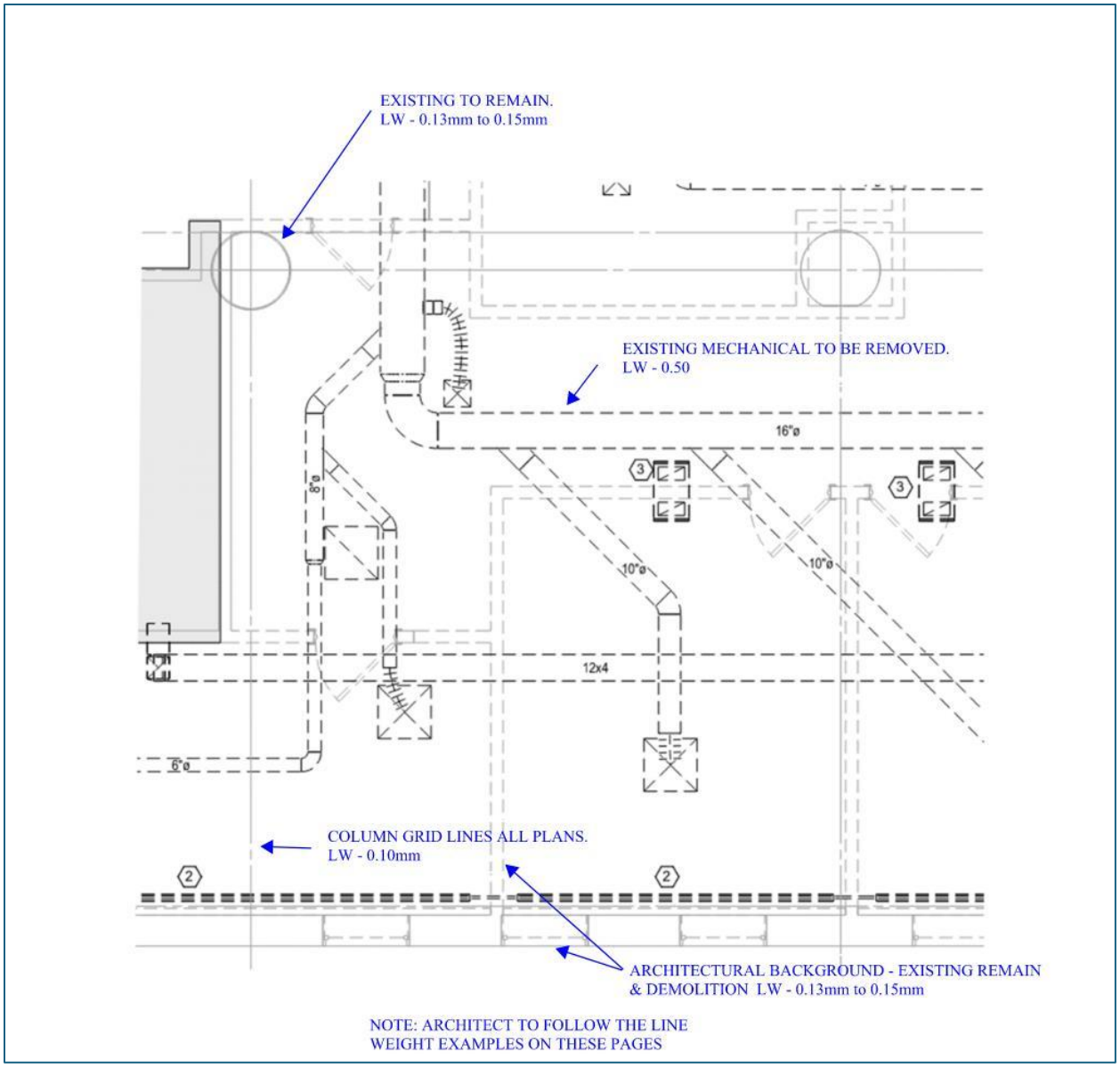

Figure 1 Example Line Weights - Mechanical Demolition

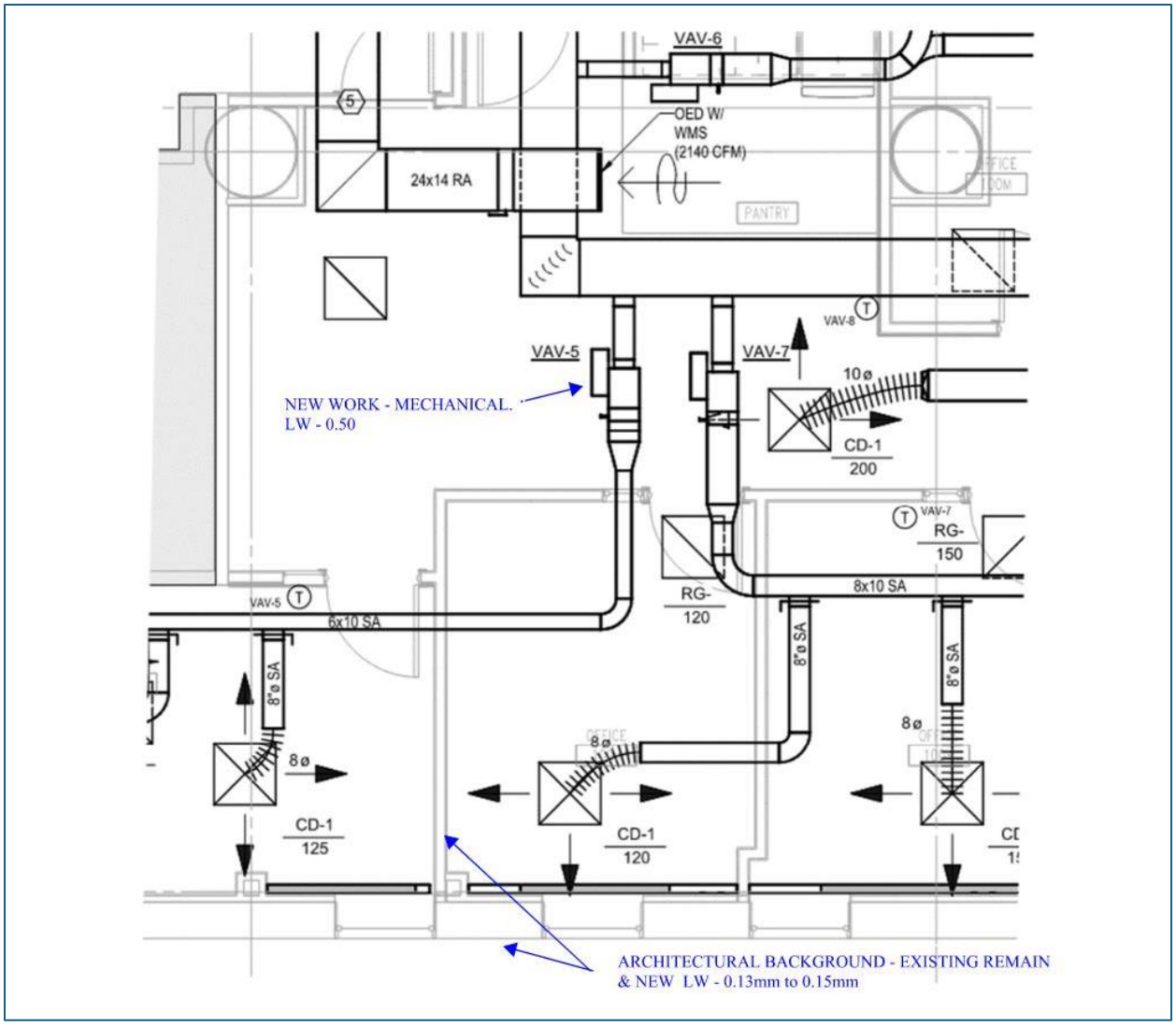

Figure 2 Example Line Weights - Mechanical New Work

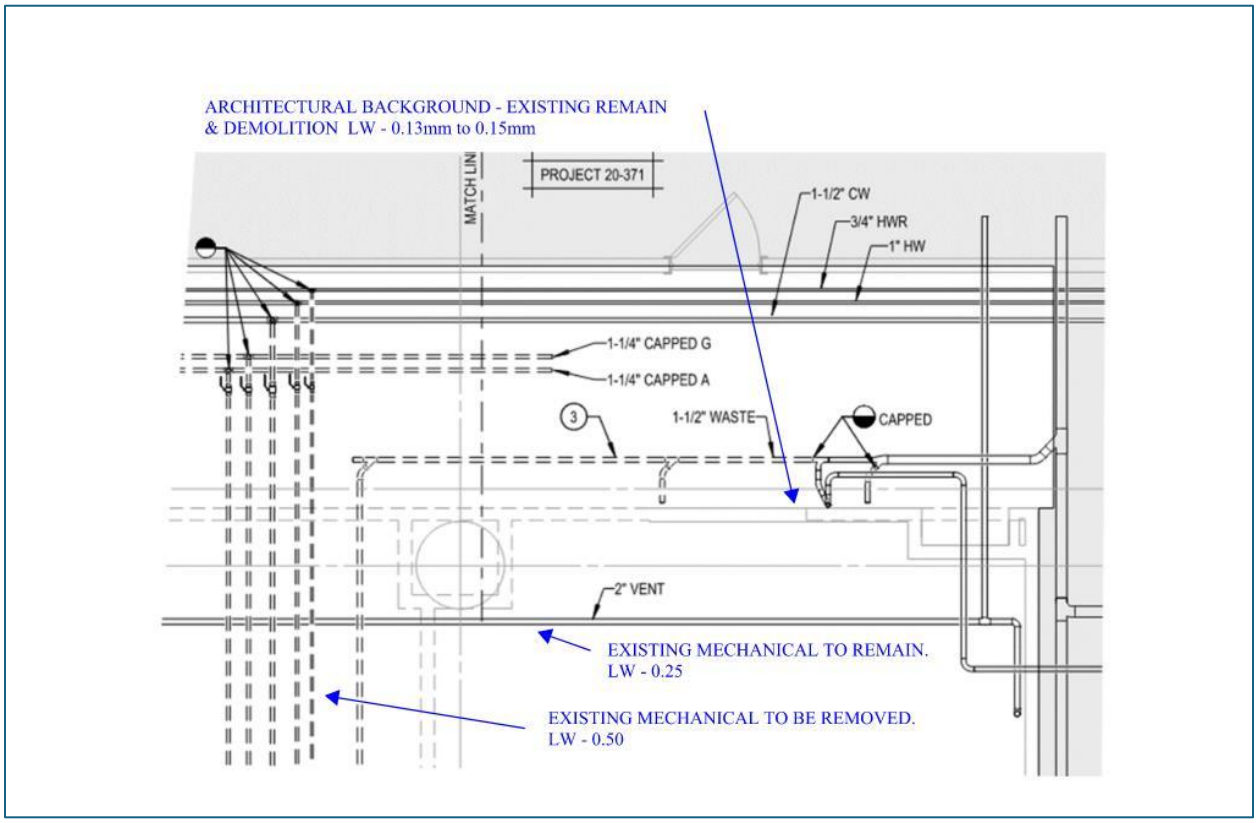

Figure 3 Example Line Weights - Mechanical Piping Demolition

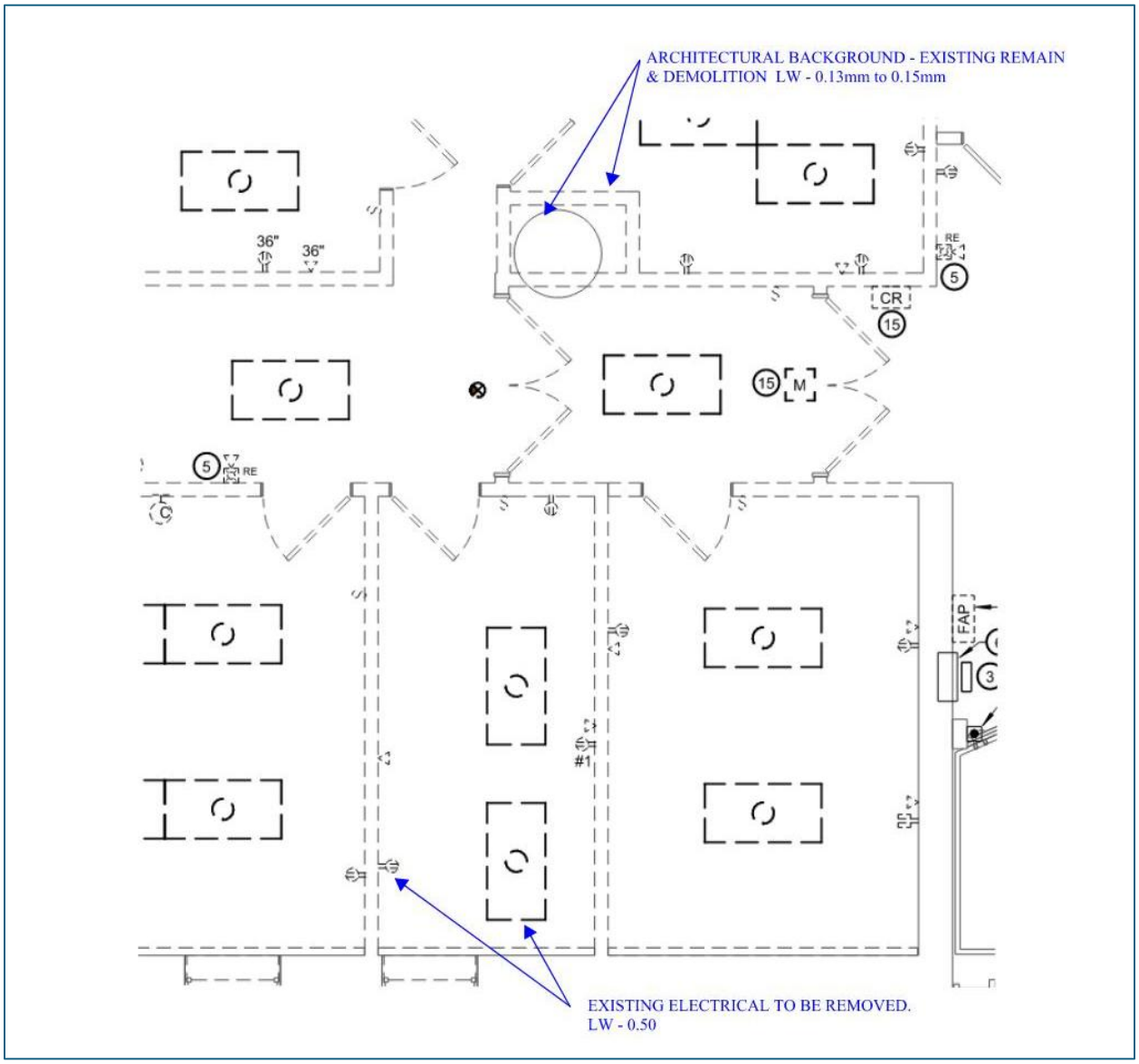

Figure 4 Example Line Weights - Electrical Demolition

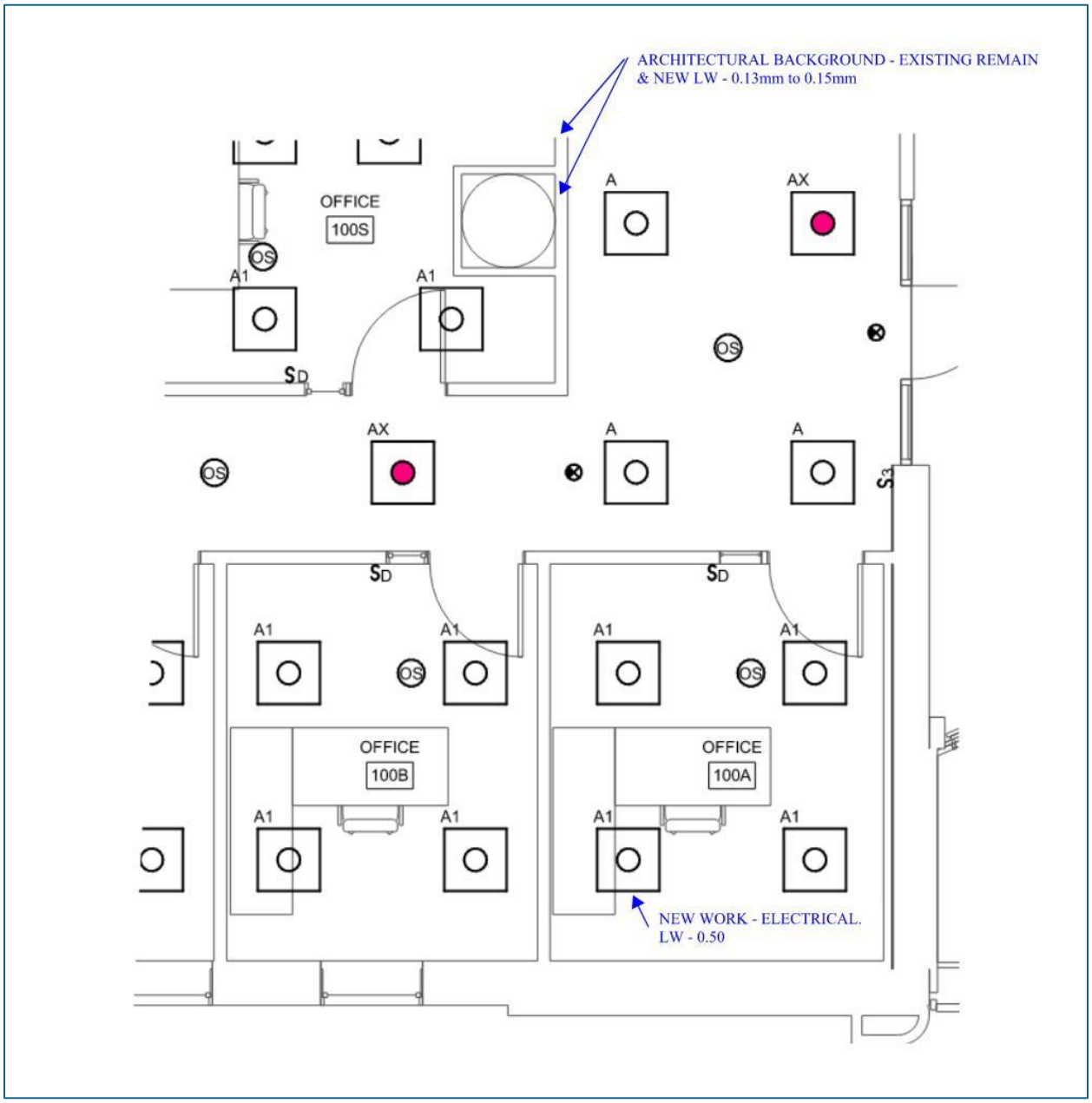

Figure 5 Example Line Weights - Electrical New Work

28.4 Deliverable File Requirements:

A. Scope:

1. This part outlines the requirements for the preparation and submission of Electronic Files to UMB, for all UMB's projects.

B. Preparation:

1. General: All submitted electronic files shall be free of viruses, using the latest version of virus cleaning and scanning software.
2. CAD Files - Deliverable Preparation: Drawing files shall be saved with index of all drawing numbers, file names, drawing titles, including the similar information for all Xref files, and blocks used.

a. Submission Check List: Verify that all drawing files comply with the following checks prior to submission:

i. Drawing file names are as required by UMB.
ii. All Entities outside the drawing limits are purged.
iii. All unreferenced blocks, layers, attributes, etc. are purged.
iv. Set the menu to the standard Autodesk Architectural Desktop Menu (acad.mnc).
v. Scan all files for viruses.
vi. Delete all unused layout tabs.
vii. Ensure that the drawing settings are in accordance with paragraph 2.2 below.
viii. All layer names comply with the AIA CAD Layer Guidelines.
ix. All Text Styles comply.
x. All Line Types comply.
xi. All Dimension Styles Comply.

b. Electronic files and documentation are due with each submittal. Reproducible drawing sets shall be provided in accordance with the A/E contract requirement.

3. Drawing Settings: These drawing settings should have the file open without error and sheet files ready to plot. Autodesk Architectural Desktop commands and variables are to be set as follows:

Commands	Settings
Base:	Insertion Base Point (0, 0, 0)
Grid	Off
Layer	Current layer '0'
Line Type	Current entity line type – By Layer, Current line type – Continuous
Menu	Standard Autodesk Architectural Desktop (acad.mnc)
Point	Display Mode 0, Size 0.0
QText	Off
Snap	Off
Text	Style - Standard
UCS	Set UCS to World
UCSICON	Set UCSICON to No Origin
Units	As appropriate for Drawing (Linear)
Zoom	To Drawing Extents

C. Drawing File Formats And Submissions

1. File Formats: All construction document files shall be submitted in "doc" "dwg," "pdf" and "rvt" file formats to the UMB Project Manager.
2. CAD Submissions: Unless otherwise directed elsewhere in these standards submit the following:
    a. CAD Bid Document Files: Submit 100% bid document files to the UMB Project Manager at the beginning of the "Construction Phase of the Project".
        i. Dwg Files: Submit 100% dwg files to UMB. Each dwg file name shall conform to the file naming standard.
        ii. Dwg PDF Files: The 100% bid document dwg "pdf" files must be signed and sealed by each A/E consultant.
    b. Closeout Document Files: Submit 100% final as built document files in "dwg", "pdf" and "rvt" file formats to the UMB Project Manager at the "Closeout Phase of the Project".
3. Word Submissions: Unless otherwise directed elsewhere in these standards submit the following:
    a. Doc File Format Submission: Unless otherwise directed by the UMB PM this submission shall be limited to 100% CD Submission and As-build word files for project specifications.
    b. All other submissions shall be in PDF file format.
4. Bookmarks: All PDF files submitted to UMB shall include bookmarks as defined in the "UMB Standard PDF File Bookmarks for A/E Submissions."

D. File Transmission:

1. File Transmission: Transmit CAD files to the UMB Project Manager by uploading files in appropriate project file folders in ebuilder. Send UMB PM a transmission notification by email when the files are uploaded in ebuilder.

E. Project Closeout:

1. Project Closeout: Before a project can be closed out and final payment from UMB rendered, all specified materials must be submitted to the UMB Project Manager in accordance with these Design Standards, the Procedure Manual and with production standards and special instructions described throughout this Chapter.

End of Chapter