

PART V: BUILDING ENVELOPE DESIGN

1. SCOPE:

- 1.1. This part outlines the minimum requirements for the design procedures for the building envelope, for new buildings, and repair and alteration projects for existing buildings on the UMB campus.

2. UMB OVERVIEW:

- 2.1. The integrity of the entire weather protection systems of University buildings must be given a first priority in the design and construction of new and replacement component systems. Most University buildings house extraordinarily expensive equipment and irreplaceable research work, as well as year around activities which should not be disrupted, all of which must be reliably protected from damage. Furthermore, the roof on most buildings serves as access to mechanical and electronic equipment as well as other operations such as window washing, painting, etc. Compounded by the number of buildings, even normal maintenance is a significant expense for the University. Therefore, only the most durable and dependable systems, including the roofing membrane, flashings, insulation, and drainage systems (including their component infrastructure), must be provided.

3. GUARANTEE AND WARRANTY:

- 3.1. The first two (2) years of warranties on all weather protection systems will be covered by the contractor, under the University General Conditions. Warranties by system manufacturers shall be from year three through ten for a total warranty period of ten years.
- 3.2. Primary weatherization systems other than roofing, such as an exterior finish and insulation system (EFIS), under deck membranes, etc. are to be warranted as indicated herein.
- 3.3. All roofs, including new and replacement and all primary roofing components, must be warranted for no less than twenty (20) years, and include a no-dollar-limit (NDL). The roofing systems shall include; roofing membranes, insulation, felts, edge metals, flashings and flashing tie-ins, vents and drains, etc as parts of the roof system and shall be guaranteed and warranted as a total system. The warranty period for roofing systems shall be covered by a twenty (20) year NDL warranty with the first two years covered by the installing contractor.

4. THERMAL AND MOISTURE PROTECTION:

- 4.1. **General Criteria:** Design criteria for selection of the thermal moisture protection system components shall be as indicated in the applicable section of this part. 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.

- 4.2. 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 build up should be avoided.
- 4.3. Uncurbed penetrations through the roof, particularly pitch pockets, shall be avoided in the design of both new facilities and renovation work. If pitch pockets are an unavoidable necessity, these should be round, and the number kept to a minimum. Prior approval for the use of pitch pockets must be obtained from UMB.
- 4.4. **Roof Access:** The A/E shall include provisions for easy access to all roof areas. The use of portable lift conveyances and portable ladders is not considered easy access.
- 4.5. **Thermal Insulation:**
 - a. **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/in² and an aged “R” Value of five (5.0) per inch.
 - b. **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/in² and an aged “R” Value of five (5.0) per inch.
 - c. **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/in² and an aged “R” Value of five (5.0) per inch.
 - d. 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/in² and an aged “R” Value of five (5.0) per inch.
 - e. 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.
 - f. 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.

- g.** 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.
- h.** Under all air intake and/or exhaust air plenum slab areas as a minimum specify a four (4) inch thick three (3.0) lb/ft² 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.
- i.** 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/ft² 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.
- j.** 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/ft² 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.

4.6. Mechanical Room Water Proofing:

- a.** Specify a polyurethane water proof 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 water proof 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.

4.7. 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 warranty period of at least ten (10) years for materials and installation.

5. EXTERIOR FINISH AND INSULATION SYSTEM (EFIS):

- 5.1.** 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.
- 5.2.** 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.

6. ROOFING SYSTEM:

- 6.1. 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.
- 6.2. 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.

- 6.3. Surfacing:** A white mineral surfaced cap sheet shall be specified as part of the roofing system, and shall be compatible with and approved for use by the roofing system manufacturer.
- 6.4. Roof Insulation:** Roof insulation shall be specified to be part of the complete roofing system, and shall be included in the roofing system warranty. 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 the 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.
- 6.5. 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.
- 6.6. 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 be in compliance 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 be in compliance with the requirements of the specified roofing system manufacturer. All flashing details shall be designed so as to eliminate the need for sealants, and sealants and caulking shall not be relied upon for water tightness.
- 6.7. Copings:** UMB prefers the use of precast concrete or cap stone copings in lieu of metal coping systems.

- 6.8. 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.
- 6.9. 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 the 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 rain water flow. The use of crickets should be considered where necessary to facilitate the flow of rain water around obstructions and equipment.
- 6.10. 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.
- 6.11. Accessories:** All roofing accessories shall be specified to be compatible with the materials and installation methods of the roofing system manufacturer.
- 6.12. Roof Drains:** Roof drains shall be designed in accordance the requirements of Section 3 MD 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.

- 6.13. Safety Barriers:** For new installations, the A/E team shall investigate and recommend a perimeter safety railing system for the roof early in the design process. Alternative systems shall be presented and discussed with UMB for selection. Alternatives could include a parapet wall of sufficient height to satisfy OSHA requirements, a permanent railing system, or provisions for a removable railing system.
- 6.14. 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.

7. EXTERIOR DOORS AND WINDOWS:

7.1. 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. **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.
- f. **Equipment Room Doors:** Exterior doors to mechanical and electrical rooms shall be of adequate size to accommodate the installation and or removal of equipment.

- g. Hardware:** For door hardware requirements see Section III AD: Interior Finish, Accessory and Specialty Design of these Design Standards.

7.2. 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.

8. EXTERIOR ARCHITECTURAL WOODWORK:

- 8.1. General:** Wood is not utilized 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.
- 8.2. Framing:** Similarly, the use of structural wood framing shall not be employed without an approved exception by UMB and the UMB Fire Marshal.
- 8.3. 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-

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resistant woods within masonry or damp conditions. Replacement work should replicate existing profiles and construction.

END OF SECTION 3 AD - PART V