

## 5.2 Exterior Wall Systems

### 5.2.1 General Requirements for All Exterior Wall Systems

1. The design and detailing of exterior wall systems and assemblies will require significant input from U of C FM&D in the areas of energy/thermal performance, building envelope detailing, and aesthetic. It is expected that the design team regularly and iteratively engage FM&D throughout the entire design process and through the preparation of construction documents. This applies to any project that impacts the exterior envelope of a building in any capacity.
2. The building envelope shall comply with all applicable requirements in Section 7.4.2 of ANSI/ASHRAE/USGBC/IES Standard 189.1-2011.
3. The design approach recommended is the "pressure equalized rainscreen insulating structure technique". This approach is characterized by the following:
  - a. Exterior cladding covering an air space pressure equalized with the exterior.
  - b. Insulation in direct and firm contact with the air barrier system. Wall assembly thermal insulation to be located outside the air barrier and inside cladding materials.
  - c. An adhered air sealing component to the exterior of structural frame and structural infill. The air sealing component in combination with the underlying structural elements forms the air barrier system.
  - d. Provision of suitable drainage and venting, see below.
  - e. Other design approaches are possible but in all cases the system selected should minimize the following:
    - i. Deterioration due to water, ice and snow.
    - ii. Trapping of condensation from humid exfiltrating air.
    - iii. Retention within the wall system of moisture for extended periods.
    - iv. Movement of structural elements that exceeds air sealing component's adhesive and structural capacity.
    - v. Displacement of insulation from intimate contact with the air barrier.
4. Materials used should be suitable for the environmental conditions and should provide a service life consistent with the planned building life. Consider accessibility for purposes of maintenance of the building components.
5. Provide suitable drainage and venting to minimize moisture, drain moisture adequately and quickly dry areas that become moist.
6. Elements that penetrate the building envelope should be avoided. Where they occur, thermal separation and control will be necessary, as will considerations for membrane and air barrier integrity.

7. Where detailing for exterior envelope finishes appear to continue to the interior, an appropriate seal at the breakpoint of transition will be necessary.
8. Vapour barriers are required in all U of C buildings and they shall be located on the warm side of insulation.
9. All heated occupied buildings on campus shall have a competent air barrier system, which requires integration into the plane of air tightness early in the design development process for all projects that directly or indirectly affect the exterior envelope.
10. A Building Envelope Professional (BEP) must be engaged before the project begins the Design Development phase. Input from a Building Envelope Professional (BEP) is required throughout the design development process.
11. If parapets are to be included, consider making them a minimum of 1,067 mm (3' 6") high as an alternate to using roof anchors.
12. Canopies, railings, safety anchors, signage and art work to be designed to resist damage from exterior exposure by being made of corrosion resistant materials, adequately coated, or sheltered from wetting.
13. Glass used as guards or canopies to be tempered and laminated.
14. All structural penetrations to support ornamentation to be designed to integrate with air and vapour barrier systems, cladding systems, and be protected from corrosion where exposed in the wall cavity.
15. All steel exposed outdoors to be hot dip galvanized and coated with a marine/industrial grade coating system: A typical system would consist of an epoxy barrier coat and aliphatic urethane topcoat.
16. All inserts set into masonry or concrete used to affix exterior ornaments to be stainless steel.
17. The U of C requires an inspection of substrate materials and surfaces before application of any air, vapour, or thermal barrier; sprayed fireproofing, dampproofing, waterproofing, roofing systems, or other special applications. After completion of the air, vapour, and thermal barrier work, a Thermographic infrared scan of the facilities will be performed of the integrity of barriers. Test results will be one of the determining factors for acceptability of the work. Cost for this scan is to be included in the contract price.

## **5.2.2 Thermal Insulation**

### **5.2.2.1 General Requirements**

1. Spray Polyurethane Insulation shall meet the requirements of CAN/CGSB-51.39, Spray Polyurethane Insulation or relevant standard.
2. Wall assembly thermal insulation is typically located outside the air barrier and inside cladding materials, neither of which are intended to be disturbed for 100 years or more. The performance of the insulation must be sustained during this service life.

3. Insulation and other thermal separations are to be located so that the interior surface temperature of all building envelope assemblies is maintained everywhere above 10° C during 2½ % winter design temperature conditions. Locate insulation to the exterior of structural elements to completely enclose non-cladding components of the envelope and to reduce thermal transfer.
4. Structural penetrations through the insulation and wall cavity, and fasteners for the insulation, are to be corrosion resistant.
5. Surfaces to receive insulation shall be designed flat and coplanar to minimize problems in fitting insulation, especially at interfaces with windows and other penetrations.
6. Secure insulation mechanically so that it is in direct contact with the outside surface of the air barrier system.
7. Flatness tolerance shall be enough that the insulation can shape to the surface profile during attachment without requiring cutting.
8. Manufacturer product data for each product proposed is to be submitted to FM&D, confirming performance compliance. Template to be obtained from U of C Project Manager and then completed and submitted to FM&D by the design team prior to Design Development.
9. Based on CUFCA (Canadian Urethane Foam Contractors Association), "Manual for Installers of Spray Polyurethane Foam Thermal Insulation", perform work in accordance with CUFCA Manual for spray-on foam insulation and related cementitious thermal barrier systems and manufacturers' written instructions. Products to be USDA and FDA approved.
10. Quality control required for spray-on insulation systems. Field inspections shall be carried out by an independent testing agency Certified Inspector in accordance with the CUFCA Manual. At completion, the testing agency to submit a site review report to confirm the adequacy of the thermal barrier installation based on applicable ASTM review and testing procedures and show no measurable air leakage nor vapour permeance greater than 0.001 L/s.m<sup>2</sup> (Type III) and 90 n.g/P.s.m<sup>2</sup> respectively. Costs of inspections and testing to be included in Contract.

#### **5.2.2.2 Materials**

1. Thermal insulation to meet any proposed or final legislation governing the use of CFC or HCFC compounds in the production or manufacturing process.
2. For plastic foam insulations, relevant current CAN/ULC Standard shall apply for establishing the required "R" value (known as LTTR "Long Term Thermal Resistance" value in this standard).
3. Expanded polystyrene insulation may not be used where in contact with ground, belowground or wet locations.
4. Provide spray-in-place polyurethane insulation at intersecting building assemblies (refer to ABC 5.3.1.3).
5. Fasteners in the wall cavities shall be of stainless steel or PVC.



6. Foil faced insulation is desirable to reduce radiant heat loss. Consider its use if the project budget permits and if a net benefit to the energy performance of the building envelope can be demonstrated.

### 5.2.3 Air Barrier Systems

#### 5.2.3.1 General Requirements

1. Coordinate design with Building Envelope Consultant.
2. Coordinate details of drainage, venting, insulation, and cladding of enclosure assemblies.
3. The air barrier is to be located on the warm side of insulation. Locate the air barrier exterior to structural elements.
4. U of C experience shows that interference from structural elements projecting through the enclosure, electrical and mechanical services, windows and doors are the most common sources of construction and service life problems with air barriers in practice. As such the air barrier is to be integrated with all components of the building enclosure such as walls, windows and door frames, roof, foundation, and service penetrations.
5. The air barrier shall have a design service life greater than or equal to the design service life of the building or be maintainable from inside the building. U of C will not accept air barrier assemblies that are not visible and require maintenance within the design service life of the building. The air barrier shall be constructed from materials that will retain the necessary air tightness, strength, and flexibility properties over the course of the design service life. The installation needs to reflect the ability of the aged materials to perform.
6. For walls enclosing heated spaces with sustained high air borne moisture loads, increase, air tightness as required to protect wall assemblies.
7. The air and vapour barriers are to be located close together in the assembly, or be of one material if possible. Any materials located between separate air and vapour barriers must be immune to moisture damage.
8. The air barrier is to be structurally supported to resist maximum wind loads, 30 year return. This is particularly important at movement joints where fatigue caused by excessive movement cycles of an unsupported membrane may cause the seal to fail.
9. The air barrier shall resist cyclic deformations caused by structural or other movement at all joints.

#### 5.2.3.2 Materials

1. Identify all air seal materials that form the air barrier assembly.
2. Air barrier materials vulnerable to moisture damage, or heat and UV aging, must be located in the assembly so as to be protected from damaging levels of wetting and radiation over the service life.
3. Minimize the number of materials used to form the air barrier system.
4. Minimize the number of changes of plane in an air barrier system and avoid use of mixed approaches.
5. Consider the need for compatibility of materials in contact with one another.

6. Organic materials lose strength and ductility as they age. Use 25% to 50% of the manufacturer's published data values in design to account for decline in tensile strength, adhesion and ductility of these materials over the service life.

## **5.2.4 Cladding Systems**

### **5.2.4.1 General Requirements**

1. Coordinate design with Building Envelope Professional.
2. Coordinate design with requirements of Campus Master Plan. Consider adjacent buildings when selecting cladding materials and colours. For building additions use complementary cladding materials.
3. Integrate design with design of windows, doors, flashing and other penetrations.
4. Identify all materials that form the cladding assembly and required support system.
5. Co-ordinate with air tightness, drainage, venting, and insulation of enclosure assemblies. Detailing of the cladding must ensure that water, snow and ice sheds safely from exterior surfaces, and are not trapped in the assembly to cause deterioration and do not cause staining of finishes.
6. Cladding shall be designed to be weather tight under sustained conditions of combined wetting and 50 Pa wind pressure.
7. Cladding shall be designed to resist 1/30 return wind loading.
8. Cladding shall be designed to resist lateral and vertical deformations of the primary structure without loss of attachment to the building.
9. Choice of cladding materials to be reviewed and approved by U of C FD.
10. Stone or brick slips (20 mm or thinner tile) adhesively bonded to stucco or sheet materials are not to be considered.
11. Design service life of claddings to be 75 years.
12. Cavities built behind the cladding shall be drained and ventilated to the exterior.
13. Cavities built behind the cladding shall be compartmentalized as required at least every second floor level, beneath the parapet, and at the outside corners of the building.
14. Construct mock-ups of all assemblies to check contractor's procedures. Test mock-ups as required to verify water tightness and resistance to structural loading.
15. Windows have a shorter design service life than cladding. Make provision for replacement of windows and other penetrations before renewal of cladding is due.
16. Provide impact protection minimum 2.4 m above grade.

**5.2.4.2 Materials**

1. Identify all materials that form the cladding assembly and closures to adjacent systems.
2. Cladding materials considered to have sufficient design service life include:
  - a. Concrete, cast in place and precast.
  - b. Anodized aluminum, class I or thicker anodizing.
  - c. Stainless steel.
  - d. Terne coated stainless steel.
  - e. Zinc.
  - f. Exterior tile, glazed/unglazed.
  - g. Slate or clay tile.
  - h. Masonry

## 5.2.5 Masonry

### 5.2.5.1 System

1. Coordinate system design with Building Envelope Consultant.
2. Reinforcing and other steel requiring corrosion protection shall be embedded so that the minimum depth of mortar, grout, or concrete cover is in all cases greater than 40 mm.
3. Stainless steel is to be used where reinforcement or other embedded metal has less cover than 40 mm.
4. Masonry, associated components, (and all materials in the wall assembly behind masonry) shall have a design service life of at least 100 years, no maintenance required for 100 years except for surface cleaning.
5. Masonry shall be structurally supported to resist maximum wind loads, 30 year return.
6. The structural back up wall for masonry veneer shall resist 1 in 30 year return design wind loading with a maximum deflection of  $L/360$ .
7. Identify tie type and spacing in specifications.
8. Provide details showing ties, masonry interfaces and support in drawings.
9. Require submittal of shop drawings to FM&D for masonry ties, masonry support.
10. Construct mock-ups of all assemblies to check contractor's procedures.
11. In order to avoid mortar accumulation within the cavity, it is recommended to specify a cavity space of 38 mm.
12. Window and door installations should be designed to allow replacement of the units without dismantling masonry.

### 5.2.5.2 Mortar and Grout

1. Mortar ingredients shall consist of Portland cement, sand, hydrated lime, potable water, and inorganic, non-staining, non-fading pigments. The use of calcium chloride or admixtures containing calcium chloride in mortar is not permitted.

### 5.2.5.3 Accessories

1. All masonry accessories to have design service lives compatible with masonry.
2. All masonry ties to be galvanized two-part ties.
3. Structural steel employed in the support of masonry and in the wall cavity shall be hot dip galvanized or stainless.





4. Where a galvanized steel or aluminum surface will be in contact with mortar or masonry, the metal shall be over coated with a layer of bituminous or other equivalent barrier material bonded over 100% of its surface area.
5. All flashings and other waterproofing accessories in the wall cavity shall be designed for a service life of 100 years. Materials considered capable of this service interval are:
  - a. Neoprene rubber sheet.
  - b. Thermo fusible SBS modified asphalt roofing membrane, fully reinforced, and fully bonded to substrate.
  - c. Asphalt modified urethane coating, fully reinforced, fully bonded to substrate.

#### **5.2.5.4 Finishes**

1. Surfaces of exterior masonry to be treated with a clear silane/siloxane type sealer after final cleaning.
2. Surfaces of exterior masonry near grade to be treated with a clear anti-graffiti type coating to a minimum height of 2440mm (8') and where required by U of C. Anti-graffiti coating systems with a wax top coat are preferred.
3. Do not specify acids for cleaning without prior written approval.

**Revision History**

<b>Revision Date</b>	<b>Version</b>	<b>Description</b>
Feb 2014	1.0	Baseline version
July 6, 2023	1.0	Added Revision History table to end of document and reset to Version 1.0.