1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 Division 03 and relevant TG sections therein
.2 Division 04 and relevant TG sections therein
.3 Division 05 and relevant TG sections therein
.4 Division 06 and relevant TG sections therein
.5 Division 07 and relevant TG sections therein
.6 Division 08 and relevant TG sections therein
.7 Section 09 00 00 Painting and Coating
.8 Divisions 20, 22, 23, 25, 26, 27 and 28
.9 UBC LEED Implementation Guide
.10 UBC Energy Modelling Guidelines
.11 Owner's Project Requirements
.12 UBC Bird-Friendly Design Guidelines
.13 UBC Vancouver Campus Plan Design Guidelines for cladding types
.14 UBC Resilience-Based Design Guide for Nonstructural Systems

1.2 Related External Documents

1. Latest edition of the British Columbia Building Code (BCBC).
2. RCABC Roofing Practices Manual.
3. Latest edition of the MPI Architectural Painting Specification Manual.

1.3 Description

1. The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.

1.4 Coordination

.1 In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
.2 These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
.3 The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.
.4 Input from a Building Envelope consultant is required in the design development process. The Building Envelope consultant is to review all building envelope details including envelope penetration details, and review comments are to be incorporated prior to tender and Building Permit issuances.
.5 Grade should slope away from the building. Consultant coordination needed between architectural, civil and landscape drawings to mitigate the differing information found on drawings from these disciplines. Provide a typical section through each building elevation to the extent that it meets existing grades.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements – Claddings

.1 Refer to Section 07 40 00 Cladding for acceptable exterior cladding types.
.2 Exterior wood cladding is not acceptable due to increased maintenance requirements, for example at the CIRS building. In the absence of a proper O&M manual, it has been very difficult to replicate the exact finish and fire-retardant treatment, even by the supplier.
.3 If the provision of exterior wood cladding is an absolute design requirement, locations are to be reviewed with the UBC Technical Review Team Architect. Such locations are also to be

protected with the use of canopies or sufficient building overhangs, in addition to the protective finish used.

.4 Make provision for maintenance access on the exterior. Provision for a genie lift or boom lift access on the exterior is to be provided. Coordinate lift and vehicular loading requirements on sidewalks with the civil engineer.

2.2 Design Requirements – Weather Barriers

.1 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.

.2 Vapour barriers are required in all UBC buildings and they shall be located on the warm side of insulation.

.3 Refer to Section 07 25 00 Weather Barriers for detailed requirements.

2.3 Design Requirements – Exterior Openings

.1 Provide appropriate screening of mechanical openings, seal cracks and maintain overall integrity of building envelope surfaces to provide effective control against rodent/pest/bird entry into buildings.

.2 At the design phase, coordination is required with the UBC Bird-Friendly Design Guidelines.

.3 Birds can be prevented from roosting on buildings or entering them by a range of physical measures. These include nets, spikes, reflective deterrents, wires and any other effort to seal potential entry points.

2.4 Design Requirements – Exterior Metal Fabrications and Coatings

.1 Canopies, guardrails and handrails, safety anchors, signage and art work to be designed to resist damage from exterior exposure and made of corrosion resistant materials, adequately coated, or sheltered from wetting.

.2 All structural penetrations to support exterior metal fabrications to be designed to integrate with air and vapour barrier systems, cladding systems, and be protected from corrosion where exposed in the wall cavity.

.3 All steel exposed outdoors (aside from exposed structural steel members in a building and canopies) is to be hot dip galvanized. Paint, if applied should consist of a marine/industrial grade coating system (a typical system would consist of an epoxy barrier coat and aliphatic urethane topcoat.

.4 Coordinate with Section 09 90 00 for painting of exposed structural steel members in buildings and canopies

.5 All inserts set into masonry or concrete, used to affix exterior metal fabrication, to be stainless steel.

.6 Coordinate with Sections 05 50 00 Metal Fabrications and Section 08 80 00 Glazing.

2.5 Design Requirements – Exterior Glazing

.1 Refer to Section 08 80 00 Glazing, 3.1 for exterior glazing requirements for guardrails and canopies.

2.6 Design Requirements – Roofs

.1 Roof design for all new buildings should include parapets or guardrails for safe and efficient roof and rooftop equipment maintenance working conditions, particularly when UBC maintenance crews need to work close to the parapet edge. Working areas are to be secured with minimum 1,067 mm (3’-6”) high insulated or thermally broken parapets or guardrails. A variance will need to be granted if guardrails or guardrail-height parapets cannot be accommodated at roof level. Section 11 81 29 would apply if a variance is granted.

.2 Guardrails shall be side-mounted to the parapet. Parapets to be of sufficient height to accommodate side-mounting of guardrail posts.

.3 All roof equipment must be mounted on curbs at least 100mm above scupper level.

.4 A roof leak detection system is required for inverted roof locations; see Section 07 50 00 Membrane Roofing.

2.7 Design Requirements - Roof Access

.1 3'-6" high guard rails or high parapets should be provided at the roof perimeter to prevent falls from the roof, and which conform to the latest edition of the BC Building Code.

.2 Mechanical or electrical roof-top equipment that is vital to the function of the building or equipment that is vital to research should be located not less than 10'-0" from the roof edge.

.3 Where roofs are accessible by faculty and students, extending one passenger elevator to roof level to provide an accessible mode of travel for UBC visitors, faculty and students.

.4 Provision of a dedicated freight elevator may be required for servicing mechanical/electrical equipment especially when a mechanical or electrical penthouse is provided. Review freight elevator requirement with the UBCV Technical Review Team or UBCO Facilities Management.

2.8 Design Requirements – Canopies and Overhangs

.1 Refer to the UBC Campus Plan Design Guidelines for design of canopies or overhangs where needed for weather protection of the public.

.2 Refer to Section 08 00 10 Openings- General Requirements for technical requirements for the design of canopies or overhangs over exterior doors.

2.9 Performance Requirements – NOT USED

3.0 MATERIALS

1. Refer to individual sections in Division 7.

4.0 LESSONS LEARNED AND COMMON MISSES ON UBC PROJECTS

Items in this section are lessons learned, and may be code or industry best practices which have been missed on past projects. If not applicable to a project, a variance is not required.

.1 Guardrail posts, whether at roof level or on upper floors, are to be side-mounted to a high enough parapet or curb, and not top-mounted through the roof assembly. Structural design should take into account side-mounting of the guardrail posts. A variance for top-mounted installations (into roof assemblies) will not be granted.

.2 All green roof details, whether at roof level or at grade are to be coordinated with the landscape and civil design. Complete details showing the landscape build-up plus drainage are to be included within the architectural detail sheets or booklet. The site plan should coordinate drainage slopes and methods with the landscape and civil designs.

.3 Penetration details (wall and roof) are to be included as part of the architectural detail sheets or booklet. Refer to Section 20 00 05 Mechanical General Requirements which notes issues with mechanical penetrations on recently built UBC buildings. It is not acceptable to have such penetration details shown only on the mechanical or electrical drawings.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 Section 01 33 00 Submittal Procedures
.2 Section 03 00 00 Concrete
.3 Section 07 00 10 Building Envelope – General Requirements

1.2 Related External Documents

.1 Latest edition of the British Columbia Building Code (BCBC).
.2 RCABC Roofing Practices Manual for horizontal waterproofing systems such as at grade green roof systems.

1.3 Description

1. Work includes damproofing and waterproofing systems.
2. The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
3. In instances where conflicts are found between the UBC Technical Guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
4. These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
5. The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.

1.4 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures
.2 O&M Submittals
  .1 Manufacturers Safety Data sheet (MSD) for all toxic or potentially toxic materials.
  .2 Environmental Product Declaration (EPD)
.3 Product data sheets for all products used in a damproofing or waterproofing system.

1.5 Quality Control and Assurance

.1 Quality Assurance
  .1 Membrane integrity testing of installed material properties including adhesion, material thickness and water tightness testing (where applicable) to be carried out by the Contractor at their expense.
  .2 RCABC warranty standards are required for all waterproofed roofs, podiums, plazas / promenades and terraces. RCABC inspections are to be conducted by an approved RCABC inspection company. Vehicle parking structures (split slabs), below grade walls, foundations, and repairs or renovations to existing waterproofing systems do not require a RoofStar Guarantee.
  .3 Contractor to provide material submittal and drawings showing any deviation from RCABC Waterproofing Standards to the UBC PM for approval and to notify UBC PM and Technical Review Team Architect of any deviations. Deviations shall be approved in writing by RCABC prior to installation in order to retain warranty coverage.

.2 Quality Control
  .1 Contractor to test moisture content of concrete substrate to verify that substrate moisture content does not exceed manufacturer's specifications. Submit testing results to UBC PM and Technical Review Team Architect prior to application of membrane.

.2 Watertightness testing of applied waterproofing on horizontal surfaces by Electronic Field Vector Mapping (EFVM) scans are to be performed prior to installation of overburden, at no cost to the Owner.

.3 Warranties

The following are required:

.1 First two years - Guarantee, secured by Performance Bond, commencing on the Final Holdback release due date.

.2 Third year to fifth year - Extended Guarantee, unsecured by Bond, commencing on the expiration of the Performance Bond. Joint and Sealant guarantee by Coating applicator and Manufacturer.

.3 Horizontal waterproofing: 5 year RCABC waterproofing warranty and detailing; 10 years Manufacturer's material warranty and Performance Bond are required. RoofStar Guarantee Standards for waterproofing are applicable for podiums, plazas / promenades and terraces only. Vehicle parking structures (split slabs), below grade walls, foundations, and repairs or renovations to existing waterproofing systems do not require RoofStar Guarantee coverage. When a 5 year RCABC waterproofing warranty is provided, the Extended Guarantee (1.5.3.2) is not required.

.4 Submit the RCABC RoofStar "Roofing Assignment and Guarantee Request" sheet with all roof guarantee certificates at closeout of project.

.5 Submit signed certificates to Consultant at closeout of project.

.4 Commissioning

.1 Contractor to repair any defects found in membrane as a result of testing or Electric Field Vector Mapping (EFVM) scan at no cost to the Owner.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 RCABC warranty standards are required for all waterproofed roofs (inverted), green roofs (inverted), podiums, plazas / promenades and terraces. Vehicle parking structures (split slabs), below grade walls, foundations, and repairs or renovations to existing waterproofing systems do not require a RoofStar Guarantee.

.2 Membranes under landscaping require access for maintenance and replacement. Pavers or other material that can be removed and re-used for hard landscaping is preferable.

.3 Membranes are not to be buried under cast-in-place concrete except as absolutely necessary at sidewalks and driveways. A variance request will need to be granted for such instances.

.4 Per RCABC requirements, electronic leak detection and monitoring is required at all green roofs and waterproofed podiums and plazas and where concrete (split slabs, tile or stone set in a mortar bed etc.) is installed above as noted above.

.5 For soft landscaping (plants etc.) over membranes use materials that can be removed with light excavation equipment and be disposed of. More valuable plants can be placed in movable planters.

.6 Membranes, primers or surface-patching materials shall be fully bonded to the surface of the concrete structure to help isolate leak locations.

.7 Concrete structures under the membrane should be sloped to drains at a minimum of 2%. Account for deflection or other subsidence of the structure when specifying and designing slopes.

.8 Cold joints at below grade foundation concrete walls should be detailed with vertical reveals to control crack propagation. All below grade foundation walls to be designed with waterstopped crack control joints, located at a minimum of 15'-0" on centre. Spacing to be confirmed with project structural engineer. Architectural details of below-grade construction

cold joints and control joints should be prepared and to be reviewed by the building envelope consultant.

.9 Apply membranes only after sustained intervals of dry weather. If construction schedule dictates application during poor weather season, select alternate waterproofing type suitable for poor weather installation. Installation shall strictly follow manufacturer's guidelines for substrate moisture content.

.10 Membranes to terminate at least 100 mm higher than the finished grade surfaces of any landscaping. Use termination bars or reglets to finish the top edge of the membrane and install counter flashing to cover and protect membrane above grade. Reglets can be used where aesthetic concerns need to be addressed. All details to meet RCABC requirements.

.11 Sills at service doors to be raised 100 mm above finished grade surfaces and be provided by ramps to grade if required to be accessible.

.12 Sills at main public access doors and at exit doors must be located flush with exterior walkway pavers. Provide a 3/4" deep recessed pocket immediately beneath the door threshold. Extend the waterproofing membrane into the recessed pocket and upturn at the back and sides of the pocket. Threshold to be set on shims to provide a flush installation with interior finishes and to reduce the risk of any tripping hazard.

.13 Exterior pavers shall be installed on pedestals to promote drainage. Pavers are to be provided with adequate spacing or provide trench drains to prevent ponding at or near doorways. Floor finishes on the interior side of these doors should not be moisture-sensitive type products.

.14 Door sills to be integrated with terminations of roofing membranes using a liquid waterproofing flashing membrane (PMMA).

.15 Subgrade membranes to be drained to perimeter drains via a permeable fill or geotextile system placed on top of the membrane.

.16 Starter curb details to be used for all curbs and planter walls on a green roof at roof level.

.17 All penetrations for irrigation, electrical or gas services to extend into a roofing jack that terminates into a drained, accessible garden box.

.18 All horizontal waterproofing membranes to be covered with protection board.

.19 Drain bodies to have clamping ring to receive membrane.

2.2 Performance Requirements

.1 Materials installed to provide required damproofing and waterproofing shall be:
- .1 Compatible with adjoining materials.
- .2 Resistant to deterioration that may reasonably be expected, given the function and exposure of the materials.

.2 The installation is not to leak at terminations, drains, upturns, or splices.

.3 The installation is to be impermeable to chloride ions such as from exposure to deicing slats

3.0 MATERIALS

3.1 Product Selection

.1 UBC-required sub-grade waterproofing system for horizontal surfaces (inverted roofs, podiums, plazas / promenades and terraces):
- .1 Low-slope applications under soft landscaping: 2-ply torch-applied SBS roofing or hot-applied rubberized asphaltic waterproofing
- .2 Low-slope application under hard landscaping: 3-ply torch-applied SBS roofing or hot-applied rubberized asphaltic waterproofing

.2 UBC-required sub-grade waterproofing system for vertical surfaces:
- .1 Based on results of geotechnical report and occupancy type, the following membrane should be considered as a minimum:
  - .1 Drained and cast in place wall at parkade with no occupied or finished areas only: damproofing with drainage composite protection.

.2 Drained and cast in place wall: 1-ply torch-applied SBS waterproofing with drainage composite protection.
.3 Drained and blind side formed wall (cast in place or shotcrete): sheet applied blind side waterproofing with drainage composite.
.4 Drained and high-risk occupancy: 2-ply torch applied waterproofing or blindside waterproofing with drainage composite for shotcrete foundations.
.5 Hydrostatic pressure and cast in place wall: 2-ply torch applied waterproofing with protection.
.6 Elevator Pits – Waterproofing system applicable for green concrete with 10 mil poly protection and drainage composite. Concrete to have crystalline waterproofing additive and waterstops used at cold joints.
.7 Hydrostatic pressure blind side: Sheet applied blindside waterproofing with protection.
.8 Hydrostatic pressure shotcrete: 2-ply SBS blindside waterproofing with protection with shotcrete foundations.
.9 Hydrostatic occupied or high risk: not allowed.

3.2 Acceptable Products

.1 Damproofing:
  .1 Damproofing materials, installed to 60mils DFT:
    .1 Tremco Tremproof 260
    .2 Epro – E Spray
    .3 Soprema – Colphene LM Barr

.2 Elevator Pit Waterproofing only:
  .1 Waterproofing materials acceptable for green concrete and installed to 90mils DFT:
    .1 Tremco Tremproof 250GC
    .2 Epro – E Spray
    .3 Soprema – Colphene LM Barr

.3 Vertical Waterproofing Materials:
  .1 Sheet applied blind side waterproofing system:
    .1 Soprema BSW
    .2 Epro Pre Tak
    .3 Grace PrePrufe

  .2 Torch-applied SBS waterproofing system:
    .1 Soprema Colphene Torch and Stick
    .2 Siplast Paradiene 20
    .3 IKO Torchflex TP 180

  .3 Blindside waterproofing with shotcrete foundation walls:
    .1 Soprema BSW
    .2 Grace PrePrufe
    .3 Epro PreTak

.4 Horizontal (Podium) Waterproofing:
  .1 Torch-applied SBS roofing membrane:
    .1 Soprema Flam 180
    .2 Siplast Paradiene 20 TG
    .3 IKO Torchflex TP 180

  .2 Hot-applied rubberized asphaltic waterproofing:

.1 Hot rubber products to conform to CGSB-37.50-M98, Standard for "Asphalt, Rubberized, Hot Applied, for Roofing and Waterproofing"
.2 Product to be an approved RCABC waterproofing system.
.1 Henry – 790-11 Hot Rubber
.2 Hydrotech 6125
.3 Soprema Colphene H

.5 Accessories:
.1 Waterstops at joints and penetrations:
.1 Swelling waterstops approved with manufacturers waterproofing system.
.2 Crystalline slurry at all horizontal concrete shotcrete joints with water stop approved by waterproofing membrane manufacturer.
.3 Drainage Composite
.1 10mm 2 layer with dimpled core and geotextile
.4 Root Barrier:
.1 10mils HDPE or 30mils LDPE complete with taped seams
.5 Pond Liner:
.1 80 mils fully welded HDPE
.6 Protection Board:
.1 3mm asphalt impregnated cover board
.2 10mm drainage composite

.6 Where specific products are listed and the consultant team would like to propose an equivalent, please provide a variance request clearly noting how the proposed product meets the performance requirements of the approved products/systems.

4.0 EXECUTION

.1 All substrate cracks in concrete substrates to be pre-treated by sawing out crack, installing bridging sealant, and reinforcing waterproofing system over the crack or as per the manufacturer's written instructions.
.2 Concrete bonding surfaces to be cleaned and prepared by shot-blasting, sand blasting, or water blasting. Remove all laitance, oils, dust, concrete paste and sack all bugholes prior to product installation.
.3 Review of below-grade application to be completed by the Architect and Building Envelope Consultant prior to backfill. Contractor shall document with photographs prior to backfill or overburden placement.
.4 Manufacturer's representative to review application on site at the request of the Consultant or UBCV Technical Review Team Architect or UBCO Facilities Management. Site review to be accompanied with written report.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

1. Section 07 00 10 Building Envelope – General Requirements
2. Section 07 10 00 Damproofing and Waterproofing
3. Section 07 25 00 Weather Barriers
4. Section 07 50 00 Membrane Roofing
5. Section 07 55 63 Vegetated Protected Membrane Roofing
6. Section 07 40 00 Cladding
7. UBC Energy and Emissions Targets
8. UBC Energy Modelling Guidelines
9. Owner's Project Requirements

1.2 Related External Documents

.1 Latest edition of the British Columbia Building Code (BCBC).

1.3 Description

.1 Work includes thermal insulation used in wall, roof and below-grade assemblies.

1.4 Coordination

.1 The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.

.2 In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.

.3 These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.

.4 The Registered Coordinating Professional is required to coordinate these requirements with other disciplines.

1.5 Product Data Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures

.2 O&M Submittals

.1 Manufacturers Safety Data sheet (MSD) for all toxic or potentially toxic materials.

.2 Environmental Product Declaration (EPD)

.3 Where required, include verification product does not contain materials identified on the Living Building Challenge 4.0 Red List – April 2022

.3 Shop drawings (including all enclosure interface details) sealed and signed by a professional Engineer.

.4 Manufacturer test data to confirm performance criteria.

1.6 Quality Control and Assurance

.1 Quality Control

.1 During construction, contractor to arrange for a third party review of spray polyurethane insulation installation. Cost of third party review to be paid by contractor.

.2 Manufacturer's representative to undertake field reviews upon request by the Consultant or UBCV Technical Review Team Architect or UBCO Facilities Management. Reviews shall be accompanied with a written field report.

.2 Commissioning

.1 Consultant and contractor to confirm installation of insulation being installed to meet project's assembly effective thermal performance requirement.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 Buildings shall meet or exceed performance requirements of latest applicable version of the BCBC.

.2 Energy modelling shall conform to:
.1 The UBC Energy Modelling Guidelines, Version 3.1
.2 Energy and Emissions Requirements based on the Project Specific Requirements.

.3 Spray Polyurethane Insulation shall meet the requirements of CAN/ULC-S705.2-98, Spray Polyurethane Insulation.

.4 Wall assembly thermal insulation is typically located outside the air barrier and inside cladding materials, neither of which are intended to be disturbed for 75 years or more. The performance of the insulation must be sustained during this service life.

.5 Insulation and other thermal separations are to be located to prevent condensation on the interior surface of all building envelope assemblies.

.6 Thermal insulation shall be placed exterior of the moisture barrier. When specific conditions limit exterior insulation amounts, split insulated walls could be considered provided at a minimum 2/3rds of the insulation clear field performance is exterior of the vapour barrier.

.7 Expanded polystyrene insulation may not be used where in contact with ground, below-ground or wet locations.

.8 Provide sufficient thermal resistance to minimize condensation at intersecting building assemblies. Consider the use of interior Spray Polyurethane Insulation.

.9 For plastic foam insulations, CAN/ULC-S770 Standard shall apply for establishing the required "R" value (known as LTTR "Long Term Thermal Resistance" value in this standard).

2.2 Performance Requirements

.1 Energy targets for new projects and major renovations are developed to reduce UBC's energy use over time and support UBC's Climate Action Plan (CAP 2030). To meet these targets, energy modeling utilizes TEDI targets.

.2 Overall effective R-values for building assemblies shall at a minimum meet the prescriptive requirements of the latest BC Building Code version, except as described in 2.

.3 For UBCV projects only, projects meeting a TEDI target, projects will be asked to confirm by consultant memo that thermal bridging calculations have been completed and how the worst impacts have been mitigated.

.4 Thermal bridging effects shall be accounted for, evaluated and provided identifying how thermal bridging will be mitigated to meet overall effective thermal performance requirements. When calculating the clear field value of assemblies (or equivalent minimum effective R-value) and the overall effective thermal performance of the opaque assemblies using the thermal transmittances between assemblies, use one of the following techniques:

.1 If the assembly matches one of those available in the online, “Building Envelope Thermal Bridging Guide: Analysis, Applications & Insights” document, then use calculated values in the document. This document is available at: https://thermalenvelope.ca/.

.2 Use two-dimensional heat transfer modeling performed by a qualified professional for thermal bridges that are continuous along one axis such as studs, exposed slab edges, balconies, z-girts, etc. or

.3 Use three-dimensional heat transfer modeling performed by a qualified professional for intermittent or point thermal bridges including repetitive penetrations such as cladding attachment screws or clips, beam penetrations, multiple canopy penetrations etc.

.4 One-off penetrations such as roof drains, louvers, scuppers or single canopy penetrations etc. need not be modeled.

3.0 MATERIALS

3.1 Product Selection

.1 Materials

.1 For plastic foam insulations, AN/ULC-S770 Standard shall apply for establishing the required "R" value (known as LTTR "Long Term Thermal Resistance" value in this standard).

.2 Expanded polystyrene insulation shall not be used where in contact with ground, below-ground or wet locations.

.3 The use of spray-in-place polyurethane (spray foam) insulation at intersecting building assemblies is accepted where deemed necessary (refer to the latest edition of BCBC, Part 5). It should be noted that spray foam insulation has very high global warming potential (GWP) and therefore only used where other insulation types cannot be used.

.4 Materials considered to have sufficient service life include:

.1 For rainscreen walls: semi rigid rock wool and fibreglass.

.2 For roofs: refer to RCABC’s list of approved products.

.3 Spray foam insulation should only be used when protected by concrete, masonry or gypsum wall board such as in a precast or cast in place sandwich application.

.5 Fasteners (attachment of cladding, sub-girts, flashings, etc.) located in the exterior wall cavities shall be of stainless steel.

3.2 Acceptable Products

.1 Mineral Wool Insulation:

.1 Non-combustible, inorganic glass fiber with thermosetting resin binder formed into insulating boards. Semi-rigid or rigid, as required by the Project.

.2 Surface burning characteristics to CAN/ULC S102. Flame spread 0, smoke developed 0.

.3 Non-combustibility to CAN/ULC S114.

.2 Extruded Polystyrene (XPS):

.1 Closed- cell, rigid extruded polystyrene, no HFC 134a with low global warming potential of less than 10 kgCO2/m2 @RSI =1,R5.68.

.2 Meet CAN/ULC-S701.1, Type 4.

.3 Fibreglass Batt:

.1 Fibreglass batt preformed, unfaced, and flexible blanket insulation for friction-fit installation in wood or steel framed cavity.

.2 Non-combustible to CAN/ULC-S702

.3 Surface burning characteristics to CAN/ULC-S102. Flame spread 0, smoke developed 0.

.4 Rigid Cellular Polyisocyanurate:

.1 Closed cell, polyisocyanurate foam core insulation bonded on each side to fiberglass facers during the manufacture process.
.2 Meet CAN/ULC-S704, Type 3 and ASTM C1289 Type II, Class 2, Grade 2.

.5 Concrete Faced Insulation Panels:
.1 Concrete topped thermal insulation boards made of closed-cell rigid extruded polystyrene (XPS) topped with latex modified concrete mix. XPS to meet 3.2.2.1.
.2 Meet CAN/ULC S701.1, Type 4.

.6 Spray foam polyurethane:
.1 Insulation: spray applied closed cell, rigid polyurethane foam to CAN/ULC-S705.1 and ASTM C1029 Type 2, two component, Medium density. Zero ozone depletion blowing agent.
.2 Meet ULC 101, Standard Methods of Fire Endurance Tests of Building Construction and Materials. (CAN/ULC S101-140) and ULC 102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. (CAN/ULC S102).

.7 Expanded Polystyrene
.1 Type I and II EPS (expanded polystyrene) insulations are permitted however are intended to be used to provide slope to drain in combination with polyisocyanurate insulation. EPS insulation to be protected by at least 2” of mineral wool or XPS insulation.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 Section 07 00 10 Building Envelope – General Requirements
.2 Section 07 40 00 Cladding
.3 Section 07 21 00 Thermal Insulation
.4 UBC Energy Modelling Guidelines
.5 Owner's Project Requirements

1.2 Related External Documents

.1 Latest edition of the British Columbia Building Code (BCBC).

1.3 Description

1. Weather-resistive barriers that are a part of exterior wall systems to protect building materials from exterior water penetration.

1.4 Coordination

1. The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
2. In instances where conflicts are found between the UBC Technical Guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
3. These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
4. The Coordinating Registered Professional is required to coordinate these requirements with other disciplines.

1.5 Submittals

1. Submit required documents to consultants in accordance with Section 013300 Submittal Procedures
2. O&M Submittals
   .1 Product data sheets.
   .2 Environmental Product Declaration (EPD).
   .3 Certification for air barrier assembly (CCMC or equivalent).
3. Product data sheets.
4. Manufacturer performance test data to confirm performance criteria.

1.6 Quality Control and Assurance

.1 Quality Assurance
   .1 Construct mock-up of assemblies to check contractor's procedures.
   .2 Test mock-ups at strategic locations for water and air tightness.
.2 Quality Control
   .1 Test strategic areas of the assembly early in the construction to evaluate performance and improve overall airtightness.
.3 Commissioning
   .1 Tier 1, 2 and 3A projects should conduct whole building airtightness testing meeting ASTM E799 or USACE Version 3 standard in accordance with BCBC Energy Step Code.
   .2 Buildings that comply with BCBC 10.2.2.1 using ANSI/ASHRAE 90.1 or NECB are required to comply to 1.5.3.1(buildings that do not comply using step code).

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 All heated and occupied buildings on campus must have an air barrier. Any materials located between separate air and vapour barriers must be immune to moisture damage (100% inorganic).

.2 The air and vapour barriers are to be located close together in the assembly, or be of one material if possible.

.3 The moisture barrier should be continuously adhered to the substrate and flashed/drained to the exterior at every two floors maximum.

.4 The moisture barrier must be continuous and flashed to the exterior to prevent entry of water.

.5 The vapour barrier is to be located on the warm side of insulation. For split wall assembiles, incorporating the air and vapour barriers together is preferred.

.6 The air barrier must be located at a thermally protected location in the assembly and must be continuous across all parts of the building above grade.

.7 Architect to provide details showing the location and continuity of the air / vapour / moisture barrier systems at all joints and junctions between enclosure assemblies (windows, doors, walls, roofs, penetrations, foundations, etc.) in the building.

.8 Architect to coordinate all wall and roof penetration details with structural, mechanical and electrical disciplines. All such details are to be provided in the architectural drawing set. Penetrations through the building envelope, and interfaces at windows and doors are the most common sources of service life and performance-related problems with air, vapour and moisture barrier systems.

.9 Architect to ensure all details have been reviewed by a Building Envelope Consultant.

2.2 Performance Requirements

.1 Air barrier materials must be located at a thermally protected location in the assembly and must be continuous across all parts of the building above grade.

.2 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.

.3 The air barrier shall have a service life equal to cladding or be maintainable from inside the building.

.4 Air and moisture barrier must be the same material and have the following properties:

- .1 Material air tightness: 0.02 l/sm2 @75pa – ASTM 2178
- .2 System air tightness: 0.2 l/sm2 @75pa – ASTM E2357
- .3 Building air tightness: 2.0 l/sm2 @75pa – ASTM E779

.5 The air barrier system shall be continuous and provide a comprehensive Whole Building Air Tightness (WBAT) of minimum 1.27 l/s.m^2 at 75Pa unless otherwise specified below or unless Energy Performance Requirement or mechanical system specifications override this requirement.

- .1 Air tightness for other specific assemblies:
  - .1 Walls behind masonry cladding 0.3 l/sm^2.
  - .2 Walls enclosing heated spaces with sustained high air borne moisture loads: Air tightness to be increased as required to protect the wall assemblies.

.6 The air barrier shall be structurally supported and resist cyclic deformations caused by structural or other movement at all joints.

.7 Air barrier system shall be tested and rated in advance of construction and/or by testing in the field during construction and commissioning to check compliance with air tightness requirements.

3.0 MATERIALS

3.1 Product Selection

.1 Air and Vapour barriers:

- .1 Exterior insulated rainscreen walls: self-adhesive non-permeable membrane sheet acting as both air and vapour barriers.
- .2 Interior insulated rainscreen walls: smart vapor retarder such as Membrane by CertainTeed.
- .3 Hybrid insulated (insulation inside and outside of stud wall) rainscreen walls: Self-adhesive waterproof membrane which are vapour permeable.
- .4 All other walls: properties and location of the vapour barrier in the assembly must comply with ASHRAE 160. Provide model results showing where the dew point will be located.

3.2 Acceptable Products

.1 Exterior Air & Vapour Barriers (Preferred):

- .1 SBS Modified Asphalt Sheet, fully adhered, 40 mils minimum, conforming to ASTM 2178, less than 1 perm vapour permeance per ASTM E 96/E 96M.
- .2 Butyl based adhesive with cross laminated facer, 20 mils minimum, conforming to ASTM 2178, less than 1 perm vapour permeance per ASTM E 96/E 96M.

.2 Exterior Air Barriers (Vapour Permeable):

- .1 Fully adhered, 20 mils minimum, conforming to ASTM E 2178, more than 10 perms vapour permeance per ASTM E96/E 96M.

.3 Interior Air & Vapour Barriers:

- .1 Polyethylene sheet, 3 mils minimum, conforming to ASTM 2178, less than 1 perm vapour permeance per ASTM E96/E 96M.
- .2 Smart vapour retarder, 1 perm maximum under dry cup conditions (ASTM E96) and 10 perms minimum under wet cup conditions.

.4 Alternative Systems:

- .1 Spray polyurethane insulation (sprayfoam) will be considered on a project specific basis due to it's very high global warming potential. Consult with the Green Building Manager, Sustainability Department if considering use.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 UBC Campus Plan: Design Guidelines
.2 Section 03 33 00 Architectural Concrete – for exterior sealer type
.3 Section 04 05 23 Masonry Accessories – for exterior sealer type
.4 Section 07 00 10 Building Envelope – General Requirements
.5 Section 07 21 00 Thermal Insulation
.6 Section 07 40 00 Cladding
.7 Section 08 00 10 Openings - General Requirements
.8 UBC LEED Implementation Guide
.9 UBC Energy Modelling Guidelines
.10 Owner's Project Requirements
.11 UBC Vancouver Campus Plan Design Guidelines
.12 UBC Resilience-Based Design Guide for Nonstructural Systems

1.2 Related External Documents

.1 Latest edition of the British Columbia Building Code (BCBC).

1.3 Description

1. Section includes exterior cladding and all structural support systems.

1.4 Coordination

1. The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
2. In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
3. These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.

1.5 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures

.2 O&M Submittals
  .1 Product specifications, type and colour.
  .2 Environmental Product Declaration (EPD).
  .3 Final reviewed shop drawings (including anchoring system for cladding and all enclosure interface details) sealed and signed by a professional engineer registered in the Province of BC.
  .4 Maintenance data and instructions.
  .5 Warranty information.

1.6 Quality Control and Assurance

.1 Quality Assurance
  .1 Construct mock-ups of assemblies where necessary to review constructability and architectural finish. Mockups can be undertaken on the building and remain in place if design and performance meet project performance and and design requirements. .
  .2 Submit cladding assembly test results for AAMA 508 Pressure Equalized Rainscreen test.
  .3 Undertake Performance Mock-up Testing, AAMA 501, on custom built cladding assemblies where performance evaluation has not been previously undertaken.
  .4 For renovation projects, a stand-alone mock-up may be desirable to confirm compatibility with existing cladding or exterior finishes.

.2 Quality Control
  .1 Construct mock-ups of all assemblies to check contractor's procedures.
  .2 Manufacturer's representative to undertake field reviews upon request by the Consultant or UBCV Facilities or UBCO Facilities Management. Reviews shall be accompanied by a field report.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 The cladding is to be integrated with all components of the building enclosure such as window and door frames, roof, foundation, and service penetrations to provide a weather tight system. The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines such as the building envelope, structural, mechanical consultants and energy modeler.
.2 CRP to coordinate with the building envelope, structural, mechanical and electrical consultants and energy modeler on the following:
  .1 Coordinate details of air tightness, drainage, venting, insulation, and cladding of enclosure assemblies.
  .2 Integrate design with design of windows, doors, flashing and other penetrations.
.3 Choice of cladding materials to be reviewed in accordance with the UBC Campus Plan Design Guidelines.
.4 Masonry veneer is one of the recommended cladding types on campus as per the UBC Campus Plan Design Guidelines. Stone or thin brick (20 mm or thinner tile) adhesively bonded to stucco or sheet materials are not to be substituted for masonry
.5 Window and door installations should be designed to allow replacement of the units without dismantling masonry wall assemblies
.6 Provide vented rainscreen systems with minimum 1/2", and preferably 3/4" capillary break and cross-cavity flashings at every second floor minimum.
.7 Provide compartmentalized cavities at least every second floor level, beneath the parapet, and at the outside corners of the building.
.8 Exterior insulated rainscreen cavities should be drained and ventilated to the exterior. Provide insect screen/bug mesh in ventilated cavities.
.9 Exposed wood structures such as glulam elements are to be sufficiently protected with adequate overhead protection and other mitigation measures.
.10 Cladding shall be designed to conform to structural and seismic design requirements

2.2 Performance Requirements

.1 Design service life of claddings to be minimum 75-years as per CSA S478 Section 6.3.5. Design service life of cladding attachment and accessories to match cladding service life.
.2 Cladding shall be designed to resist lateral and vertical deformations of the primary structure without loss of attachment to the building.
.3 Energy targets for new projects and major renovations are developed to reduce UBC's energy use over time and support UBC's Climate Action Plan (CAP 2030). For maximum overall effective thermal transmittance of building assemblies – refer to section 07 21 00, 2.2.
.4 Thermal bridging effects shall be accounted for, evaluated and provided identifying how thermal bridging will be mitigated to meet overall effective thermal performance requirements. Refer to Section 07 21 00, 2.2.4 for techniques to be used.
.5 Cladding shall be designed to be weather tight under sustained conditions of combined wetting and 500 Pa wind pressure.

3.0 MATERIALS

3.1 Product Selection

.1 Identify all materials that form the cladding assembly and closures to adjacent systems.

.2 Cladding material choices should be coordinated with the UBC Campus Plan Design Guidelines that apply to each campus. The following exterior cladding types are considered to have a sufficient design service life and acceptable for use:

- .1 Masonry coated with clear penetrating sealer as per Section 04 05 23.
- .2 Concrete, precast - the recommended approach is to use exterior insulated precast concrete or precast sandwich panels
- .3 Architectural concrete, coated with clear, penetrating sealer as per as per Section 03 00 00 or elastomeric paint with interior insulation under 1:4 overhang ratio.
- .4 Anodized aluminum composite panels, class I or thicker anodizing
- .5 Stainless steel, terne-coated stainless steel or zinc
- .6 Exterior porcelain /ceramic-faced panels
- .7 Terracotta panels
- .8 High density fiber cement boards Grade II, Type A conforming to ASTM C1186.
- .9 Wood siding/cladding but with the following limitations:
  1. Exterior vertical applications of cedar or Accoya wood. All exterior wood cladding applications are to be protected with an adequate-sized canopy or building overhang.
  2. Wood in exterior soffit applications are acceptable.
  3. Specify institutional grade coatings for all wood cladding types.

.3 Wall systems allowed:

- .1 Vented rain screen systems with min 3/4" capillary break and cross cavity flashings at every second floor minimum.
- .2 Unvented mass wall systems with insulation separating exterior wythe and interior moisture barrier or mass wall and vented rain screen joints.
- .3 Coated architectural concrete with interior spray foam insulation, complete with crack control reveals.
- .4 Uncoated architectural concrete with interior cementitious waterproofing (such as a Xypex) and interior spray foam insulation, complete with crack control reveals. Precast concrete panels are preferred instead.

.4 Cladding types not permitted:

- .1 Exposed architectural concrete with interior insulation.
- .2 Exterior Insulation and Finish System (EIFS)
- .3 Stucco

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 Section 07 00 10 Building Envelope – General Requirements
.2 Section 07 21 00 Thermal Insulation
.3 Section 07 55 63 Vegetated Protected Roofing
.4 UBC LEED Implementation Guide
.5 UBC Energy Modelling Guidelines
.6 Owner's Project Requirements

1.2 Related External Documents

1. Latest edition of the British Columbia Building Code (BCBC).
2. RCABC Roofing Practices Manual.

1.3 Description

.1 Work includes 2- ply SBS membrane roofing system complete with all related assembly components, fasteners, adhesives, cover boards, underlays, insulation, membranes and all roof related hardware and flashings as appropriate to the building and as specified.
  .1 In addition to the above, and in the case of re-roofing, the assembly shall include wood blocking additions and/or modifications as required to meet the requirements of the new roofing assembly.

1.4 Coordination

.1 The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
.2 In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
.3 These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
.4 The Registered Coordinating Professional (CRP) is required to coordinate these requirements with other disciplines.

1.5 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures

.2 O&M Submittals
  .1 Manufacturer's product data sheet for each product provided, type and colour, including MSDS data.
  .2 Manufacturer performance test data to confirm performance criteria.
  .3 Sloped insulation, cricket and/or back slope plan.
  .4 Manufacturer's leakproof warranty.
  .5 Manufacturer's confirmation of training – if needed.
  .6 Fastening patterns and sheet layout for mechanically attached membrane assemblies.
  .7 Environmental Product Declaration (EPD)

1.6 Quality Control and Assurance

.1 Quality Assurance
  .1 Meet or exceed the RoofStar Guarantee 5-Year guarantee standards All roofing system products to conform to the RoofStar Guarantee Standards and to the appropriate CSA, CGSB, ULC, CULC, and ASTM Standards for the materials used in the roofing system; products to be listed in the RGC Accepted Materials List of the RoofStar Guarantee

Roofing Practices Manual, and to be in conformance with the manufacturers' published product and performance data.

.2 Quality Control
- .1 An Independent Inspection Agency acceptable to RoofStar Guarantee, and assigned by RoofStar Guarantee on acceptance by the Consultant and the UBC Project Manager, to conduct field review inspections as per the minimum protocols as set forth by the RoofStar Guarantee for their 5 Guarantee Program. It is understood that in addition to these responsibilities the independent inspection agency will provide re-inspection services at the 2year anniversary – in the case of the 5 year warranty.
  - .1 Cost for the warranty and inspections are to be included in the contract sum.
- .2 UBC reserves the right to increase the field review inspection frequency to FULL TIME site inspections while the work is in progress. Extra costs for this to be borne by UBC.
- .3 Added inspections just prior to the expiration of the warranty, if required, will be arranged and the costs borne by UBC.
- .4 A manufacturer's representative to also inspect the work as required for the purposes of providing the manufacturer's labour, material and workmanship warranty upon completion.

1.7 Warranties
- .1 Provide the RoofStar Guarantee Roofing System Record, to include the RoofStar Guarantee standard 5-Year Guarantee, copies of Inspection Reports, listing and literature of all products used, and Roof Maintenance Guide.
- .2 Provide a manufacturer's warranty certificate, including any extended warrnties.
- .3 Where adhesive is used in the assembly, include and provide the adhesive manufacturer's warranty.
- .4 Active or passive roof leak detection system warranty.
- .5 All warranties to commence at date of Substantial Performance.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements
- .1 Roofing is to be designed to meet Guarantee Standards of the Roofing Contractors Association of British Columbia Guarantee Corp. (RoofStar Guarantee) as published in the "RGC Roofing Practices Manual" ("RPM") and requires a minimum 5 (five) year RoofStar Guarantee.
- .2 Roofing is to be designed to CSA 123.21 Wind Uplift Standards.
- .3 New and re-roof assemblies shall have a minimum of 2% slope to drain. This can be achieved by structural slope, sloped insulation, cricket and back slopes or any combination of these.
  - .1 A variance request will need to be granted for any deviations. Consideration will only be given where existing building conditions will not allow for excessive tapered insulation elevations, for example, low window sills, low door thresholds or poor drain locations.
- .4 The design service life of low-sloped roofs is to be a minimum of 25years
- .5 As per RCABC requirements, for green roofs at grade or roof level (inverted roofs) with soil or landscape buildup or cast concrete or asphalt (non-removable topping), a RoofStar Guarantee approved passive roof leak detection system must be included in the assembly. Inverted roofs with gravel ballast or pavers do not need to have a roof leak detection system as these are easy to open up and leaks can be traced when required. Refer to 3.1..4 in this section for further details.
- .6 An active (monitored) roof leak detection system is required for high value buildings such as museums, libraries and research facilities. Libraries with conventional roof systems can be provided with a passive leak detection system.
- .7 Initial EFVM scan and leak locate system is required for all inverted roof assemblies.
- .8 Monitored leak detection is NOT Required in the following situations:
  - .1 Conventional roofing over steel deck or vented wood space.

.2 Conventional roofing over concrete deck.

.9 Performance standards for roof insulation are set out in Section 07 21 00 Thermal Insulation

.10 The installation of concrete or asphalt topping over 2 ply SBS membrane roofing is not permitted. A variance will need to be granted for such installations.

.11 Hot rubberized asphaltic type membrane is acceptable where hard to access surfaces are present.

.12 Vapour retarders are to be included in all assemblies and shall be fully adhered to the substrate. Products shall be appropriate to the building envelope configuration and be installed so as to wrap and envelope the insulation, compatible for connection to the building envelope air barrier, and be sealed at all penetrations. Laminate Kraft paper and adhesive is not an acceptable vapour retarder.

.13 In conventional roof assembly, insulation is to be adhered with two-part urethane adhesive. In the case of conventional roof assembly over wood frame decking, screw fasten the first layer and adhere the upper layers (this reduces thermal bridging and eliminates washer heads at fasteners from showing through the roofing membrane).

.14 Insulation overlay board is to be installed over the insulation and under the roof membrane in all cases even if manufacturers' minimum standards do not require it. This requirement would also apply with mineral fiber insulation board which have an integral facer to receive the membrane.

.15 Roofing membranes are to be fully adhered, or torched applied 2 ply SBS modified bitumen membrane. A variance will need to be granted for alternative roofing membranes. A variance request noting the performance comparisons with a 2 ply SBS membrane roof will need to be provided for review.

.1 For re-roofing projects, systems and assemblies that do not require the use of hot asphalt, kettles or tankers are to be used.

.16 Drains

.1 For new construction all drains shall be cast iron and include all appropriate hardware.

.2 Cast iron drains shall be re-used when re-roofing, and complete with drilled and tapped stud holes and new hardware as required to function as originally designed and installed.

.3 At all cast drains, tie-in is to be done with the application of reinforced PMMA stripped into the drain.

.4 All drain baskets, strainers or screens shall be cast iron or aluminum, plastic will not be permitted.

.5 The use of drain inserts will only be considered when dictated by building configurations or circumstance. A variance will need to be granted for such instances.

.6 If drain inserts must be used a "U-Flow" or Menzies "Blue Seal" connection seal shall be utilized when a hard plumbing connection is not possible. O-rings are not acceptable.

.7 All drains are to be sumped minimum 2' with sumps turned 45º degree to direction of roofing plies.

.17 Membrane plies are to extend over the top of all parapets and 50 mm down past blocking and lapped over the outside surface of the wall finish. Where nailable substrates exist, the membrane shall be mechanically secured (nailed) on the outside face.

.18 Where the top edges of the stripping plies terminate on higher walls the stripping plies are to terminate in such a way as to obtain two seals on the vertical wall face (cap stripping to extend up past base sheet and obtain a separate seal to the substrate.

.1 All stripping plies shall be mechanically terminated to the substrate at least 200 mm above the roof surface.

.2 Top edges of membranes are to be protected by counter flashings.

.3 In new construction, reglets will be installed to allow for the installation of membrane plies and or flashings. Gum lip flashings are not permitted.

.4 In re-roofing projects where reglets cannot be re-used or are not present and gum lip flashings must be used, installation shall be "double gum lip" as per RCABC Guarantee standards RPM detail.

.19 Install walkway paths at all access door and hatches, around all rooftop mechanical and other equipment requiring maintenance, and from there leading to the main roof access stairs, ladders, or roof hatch.

.20 Provide overflow scuppers in accordance with the latest applicable edition of the British Columbia Plumbing Code. Install overflow scuppers at height below the height of door sills wherever possible and at a location visible and able to be maintained.

.21 For green roof installations at grade, see requirements for below-grade waterproofing system in Section 07 10 00.

2.2 Performance Requirements

.1 Life Cycle Expectation

.1 Minimum 25 year service life expectancy

3.0 MATERIALS

3.1 Product Selection

.1 System at Low-Slope Roofs

.1 2-ply SBS Bituminous Modified Flexible Membrane Roofing System, exposed, insulated, adhered, generally torch-applied. Refer to RoofStar Guarantee Manual Outline Specification for this system, from which the following are preferred options for UBC.

.1 Thermal barrier/underlay at steel deck to be provided where required by code: shall be minimum ½" gypsum board.

.2 Vapour retarder is required on all roofing assemblies and shall be adhered SBS modified bitumen sheet.

.2 Steel or wood decks shall receive primer as prescribed by the membrane manufacturer. Membrane shall be peel and stick, self-adhered or adhered appropriate to the membrane manufacturer and the specified roofing assembly. Kraft vapor retarders are not acceptable.

.3 Concrete decks shall receive primer as prescribed by the membrane manufacturer. Preferred membrane application shall be fully adhered and torch applied.

.4 Insulation overlay shall be ¼" inch or ½" inch "Dens Deck" and be adhered or mechanically attached through to the substrate as determined by the substrate and the requirements of the assembly.

.1 Note that 2 (two) layers of insulation overlay are required when installed over heat sensitive insulations.

.2 Coordinate with Section 07 21 00 Thermal Insulation for effective R value of insulation for both new and re-roofing assemblies. The effective R value of insulation is to be measured at 0°C. For new roofs, it is recommended toexceed the minimum requirements of the latest version of the BC Building Code.

.1 Insulation for use in conventional assemblies, the preferred roofing configuration, is polyisocyanurate or mineral fibre.

.2 Type I and II EPS (expanded polystyrene) insulations are permitted however are intended to be used to provide slope to drain in combination with polyisocyanurate insulation.

.3 Type IV XPS (extruded polystyrene) is intended for use only in inverted roofing assemblies and is to be considered only when inverted roofing is unavoidable. Use products with the lowest possible global warming potential; HFC blowing agents are not permitted.

.4 Insulation installed in conventional assemblies shall be installed in two layers with a minimum 12 inch offset and stagger between layers (for example 2 layers of 2 inch as opposed to 1 layer of 4 inch).

.5 Insulations installed in adhered assemblies are to be maximum 4' X 4' in size. Insulation installed in mechanically attached assemblies to be a maximum of 4' X 8' in size

.2 Attachment

.1 For installation on wood or steel decks to meet CSA 123.21 Wind Uplift Standards and/or as required to FM (Factory Mutual) 1-90 whichever is greater.

.2 Fasteners: minimum number of fasteners and stress plates for installation on wood or steel decks to be as specified by the RoofStar Guarantee Manual for 5/10 Year Guarantee standards and/or as required to FM (Factory Mutual) 1-90 whichever is greater.

.3 Adhesives: adhesive application rates when used in adhering insulations and coverboards on concrete decks shall meet or exceed the requirements of the RGC, the manufacturer and FM requirements for 1-90.

.1 The preferred adhesive for all assemblies is a two-component polyurethane such as Insta-Stik by Dow Chemical or similar.

.3 Roof Penetrations

.1 All penetration hardware to have only one line or cable per flashing installation and shall incorporate a gooseneck hood, heat shrink or uncured EPDM membrane wrap c/w stainless hose clamps. Tape, putty or caulkings are not acceptable.

.4 Multiple lines or cables installed in only one penetration flashing is only acceptable when a purpose made hood or gooseneck is installed and that said lines or cables are slack enough to allow for a significant downward belly in the lines/cables.

.3 Roof Level Accessories

.1 Install roof walkway paths from all access door and hatches, around all rooftop mechanical and other equipment requiring regular maintenance, and from there leading to the main roof access stairs, ladders, or roof hatch.

.1 Walkways to be either a reinforced walkway, cap sheet manufactured by the same manufacturer as the roof membrane, or 2' x 2' x 2" precast plain finish concrete paver slabs on pedestals (no substitutes such as duckboards or poured-in-place concrete).

.2 Install paver slabs approx. 2" inch apart and away from cants and flashings, in a regular and uniform pattern.

.4 Roof Leak Detection Systems

.1 The roof leak detection system must meet RoofStar Guarantee requirements as laid out in the RCABC Roofing Practices Manual.

.2 Active (or monitored) roof leak detection systems must have the capability of issuing email alerts complete with a graphic of the roof indicating the location of the leak and must also be capable of issuing alarms to the BMS system.

.3 The roof leak detection system can be hard wired or connected via BACnet to the UBC BMS system. Project team to coordinate with the UBC BMS group.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

1. Section 07 00 10 Building Envelope – General Requirements
2. Section 07 21 00 Thermal Insulation
3. Section 07 55 00 Membrane Roofing
4. Section 07 62 00 Sheet Metal Flashing & Trim
5. Division 32 - for landscape maintenance
6. UBC LEED Implementation Guide – for water use for irrigation
7. Safety and Risk Services policies for health and safety

1.2 Related External Documents

1. Latest edition of the British Columbia Building Code (BCBC). The BC Building Code requires that all roofs, except when permitted (tents, inflatable structures, certain small "assembly occupancy" buildings), must be Class A, B, or C, as determined in accordance with CAN/ULC-S107-10 "Standard Methods of Fire Tests of Roof Coverings."
2. RCABC Roofing Practices Manual.
3. Refer to Canadian Landscape Standard, current edition, Section 13 - Landscape over Structure and BC Standard for Extensive Green Roofs, and CMHC Roof Deck Design Guidelines.

1.3 Description

1. A vegetated (green) roof system has a variety of typologies primarily based on growing media depth and vegetative selection. Common types include extensive, rooftop agriculture, modular, and intensive.
2. All typologies include, at minimum, the following basic components: vegetation, growing media, filter fabric, edging, vegetative free zone ballast, drain mat, and root barrier.
3. A loose laid vegetated roofing system includes all base components installed with individual layers laid over each other.
4. A modular (tray) vegetated roofing system includes all base components with some components being loose laid and others enclosed in a multifunctional modular product.

1.4 Coordination

.1 The guidelines apply to all work completed within buildings on the UBC Vancouver campus. Green roofs are NOT supported at the UBC Okanagan campus.

.2 In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect.

.3 These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.

.4 The Registered Coordinating Professional (CRP) is required to coordinate these requirements with other disciplines. Projects with vegetated roof system require close and early design coordination among the landscape architect, architect, structural engineer, building envelope consultant, mechanical engineer and manufacturer to ensure that the landscape design objectives are integrated into the structural design. Special consideration around waterproof membrane compatibility, irrigation, water drainage and or retention/detention systems, maintenance access, glazing reflectivity, and weightbearing capacity are of critical importance.

.5 CRP to coordinate architectural AND landscape green roof detailing.

.1 For at grade green roof assemblies, CRP to coordinate green roof drainage requirements with both landscape architect and civil engineer.

.6 Submittal of a maintenance plan for the vegetated or vegetated-hybrid system is mandatory at the design stage and requires coordination between the landscape architect, manufacturer, landscape contractor and Landscape Architect in UBC Municipal Services. Special consideration to the establishment phase, warranty conditions, safety, and rooftop access of maintenance equipment should be addressed.

.7 Coordination between the project Landscape Architect, supplier, and Landscape Architect in UBC Municipal Services is required for vegetative and growing media selection. Should the vegetated roof be desired to provide stormwater detention, project specific rainwater detention evaluation should be provided for the green roof assembly.

1.5 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures

.2 O&M Submittals
- .1 Submit two (2) copies of the most current technical data sheets. These documents must describe the physical properties of materials [and explanations about product installation, including restrictions, limitations and other manufacturer recommendations].
- .2 Green roof components shop drawings.
- .3 Sheet metal flashing shop drawings.
- .4 Planting material information and maintenance data as per Division 32 requirements.
- .5 Manufacturer's confirmation of training – if needed.
- .6 Environmental Product Declaration (EPD).
- .7 Manufacturer performance test data to confirm performance criteria.
- .8 Manufacturers Safety Data sheet (MSD) for all toxic or potentially toxic materials.

1.6 Quality Control and Assurance

.1 Quality Assurance
- .1 Meet or exceed the RoofStar Guarantee 5-Year guarantee standards. All roofing system products to conform to the RoofStar Guarantee Standards and to the appropriate CSA, CGSB, ULC, CULC, and ASTM Standards for the materials used in the roofing system; products to be listed in the RGC Accepted Materials List of the RoofStar Guarantee Roofing Practices Manual, and to be in conformance with the manufacturers' published product and performance data.
- .2 Certificates of qualification may be part of the documents required for submission. Where applicable, these requirements shall be part of the call for tender(s).
- .3 The contracted installer and his subcontractors must be officially recognized as authorized contractors by the vegetated roofing system supplier at the time of tendering and throughout installation.
- .4 Required work may be carried out only by applicators who have been trained in the application of the green roofing systems and who are employed by an enterprise which has the adequate and necessary equipment.
- .5 A representative of the waterproofing materials manufacturer can be present on the worksite at commencement of work or at any other time during the work, as required.
- .6 The contractor must at all times enable and facilitate access to the worksite and the roofs for the said manufacturer's representative.

.2 Quality Control
- .1 An Independent Inspection Agency acceptable to RoofStar Guarantee, and assigned by RoofStar Guarantee on acceptance by the Consultant and the UBC Development Manager, to conduct field review inspections as per the minimum protocols as set forth by the RoofStar Guarantee for their 5 Guarantee Program. It is understood that in addition to these responsibilities the independent inspection agency will provide re-inspection services at the 2 year anniversary – in the case of the 5 year warranty.
  - .1 Cost for the warranty and inspections are to be included in the contract sum.
  - .2 UBC reserves the right to increase the field review inspection frequency to FULL TIME site inspections while the work is in progress. Extra costs for this to be borne by UBC.
  - .3 Added inspections just prior to the expiration of the warranty, if required, will be arranged and the costs borne by UBC.

.4 A manufacturer's representative to also inspect the work as required for the purposes of providing the manufacturer's labour, material and workmanship warranty upon completion.

1.7 Warranties

.1 Provide the RoofStar Guarantee Roofing System Record, to include the RoofStar Guarantee standard 5-Year Guarantee, copies of Inspection Reports, listing and literature of all products used, and Roof Maintenance Guide. All roofing system products to conform to the RoofStar Guarantee Standards and to the appropriate CSA, CGSB, ULC, CULC, and ASTM Standards for the materials used in the roofing system; products to be listed in the RGC Accepted Materials List of the RoofStar Guarantee Roofing Practices Manual, and to be in conformance with the manufacturers' published product and performance data.

.2 Provide a membrane manufacturer's warranty certificate.

.3 Where adhesive is used in the assembly, include and provide the adhesive manufacturer's warranty.

.4 Active or passive roof leak detection system warranty.

.5 All warranties to commence at Date of Substantial Performance.

.6 Retain relevant articles when an extended vegetative roofing material warranty is requested in addition to a waterproofing system warranty (warranty of the membrane manufacturer). Refer to extended warranty providers requirements to ensure continuity between manufacturers recommendations and warranty requirements.

.7 The membrane manufacturer will issue a written document in the owner's name, valid for a 5-year period, stating that it will remove and reinstall the vegetative system components to repair any leaks in the roofing membrane to restore the roofing system to a dry and watertight condition, to the extent that manufacturing or installation defects of one or several components caused such water infiltration. The warranty must cover the total cost of repair(s) during the entire warranty period. The warranty certificate must reflect these requirements.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 Green roof systems are to be designed to meet the Guarantee Standards of the Roofing Contractors Association of British Columbia.

.2 Structural Deck System Requirements

- .1 Conventional Vegetated Green Roof Assemblies
  - .1 Concrete roof deck structures
  - .2 Wood framed roof deck structures
  - .3 Steel deck structures
  - .4 Inverted vegetated green roof and podium assemblies
  - .5 Concrete deck structures only

.3 Inverted roof assembly requirements to be as per Section 07 10 00 Damproofing and Waterproofing.

.4 Conventional roof system requirements to be as per Section 07 55 00 Membrane Roofing.

.5 Performance standards for roof insulation to be those set out in Section 07 21 00 Thermal Insulation.

.6 Roof penetrations are to be designed to RCABC standards. Additional information can be found in 2.1.13.

.7 Vapour retarders

- .1 Vapour retarders are to be included in all assemblies and shall be fully adhered to the substrate. Products shall be appropriate to the building envelope configuration and be installed so as to wrap and envelope the insulation, compatible for connection to the building envelope air barrier, and be sealed at all penetrations. Laminate Kraft paper and adhesive is not an acceptable vapour retarder.

.8 Minimum slope for drainage and roof drains
- .1 New and re-roof assemblies shall have a minimum of 2% slope to drain. This can be achieved by structural slope, sloped insulation, cricket and back slopes or any combination of these.
- .2 Roof drain requirements to be as per Section 07 50 00, 2.1.16.

.9 Confirm inclusion of root barrier across project documents. It should be specified/referenced in both architectural AND landscape architecture documents.

.10 For systems with a greater than 15% slope modular systems, consult with the manufacturer for product requirements, placement, and compatibility

.11 Root Barrier
- .1 The root barrier should be detailed overtop the waterproofing membrane, across the entirety of the roof field. It should run up all projections, drains, and/or vertical interfaces to meet the highest point of growing media and ballast.
- .2 Root barrier layer breaks should be detailed with, at minimum, a 1 foot overlap- fastened with a manufacturer approved fastener. Alternatively, 3 foot overlaps without tape are acceptable.

.12 Drainage mat
- .1 Drainage mat must run continuous across the roofing field in order to facilitate water movement to drain. Therefore, it must encompass both the delimitated vegetative free zones and vegetated zones.
- .2 The drainage mat should be detailed between root barrier and filter cloth, across the entirety of both the vegetated and vegetative free zone roofing field. Therefore, it should be detailed under the filter cloth, metal edging, and vegetative free zone ballast. It should be detailed flush to all drains, projections, and interfaces.
- .3 In a protected roofing assembly (PMA) roofing assembly the drainage mat must be an open diffusion product, and it's placement will change. It should be detailed between the XPS insulation layer and the filter cloth, across the entirety of the vegetated and non-vegetated roofing field.

.13 Edging
- .1 The edging should be detailed on top of the drain mat and between the filter cloth and the drainage mat, adjacent to the vegetation free zone ballast.

.14 Vegetation free zone
- .1 Vegetation free zones are essential to reduce potential clogging of essential systems like drains and help maintain plant health by providing maintenance paths. Minimum recommended widths are to improve ease of access for maintenance staff and reduce likelihood of vegetative infiltration of roofing components.
- .2 Vegetation free zones should be detailed around all roof penetrations such drains, roof anchors, parapets, and other rooftop projections like mechanical and electrical services and equipment, and/or high traffic areas.
- .3 The vegetation free zone (river rock) should be detailed between the edging and the perimeter parapets and all roof projections. It should be detailed to go over the root barrier and drain mat to ensure adequate drainage.
- .4 Vegetative free zone ballast should be lower than the adjacent growing media found in the vegetative zone in order to reduce maintenance issues and for maintenance ease of use.
- .5 The vegetation free zone should be detailed at 300mm (12") wide for linear edges and with a 300mm radius around roof drains and other roof projections.

.15 Filter fabric
- .1 To prevent growing media seepage, it's essential that the filter fabric runs up the vertical interface of the edging, to the top of the edging.
- .2 The filter fabric should be detailed overtop of the drain mat, across the vegetated roofing field, overtop and up the vertical interface to the top of the edging.
- .3 Filter fabric breaks should be detailed with, at minimum, a 1' overlap.

.16 Growing media
  .1 Growing media should be detailed between the vegetation and the filter fabric, within the vegetated roofing field.
.17 Vegetation
  .1 Vegetation should be detailed at the top of the system, above the growing media, within the vegetated roofing field.
.18 Roof leak detection system
  .1 For green roofs at grade over suspended slab or at roof level (inverted roofs) with soil or landscape buildup, a RoofStar Guarantee approved passive roof leak detection system must be included in the assembly.
  .2 An active (monitored) roof leak detection system is required for high value buildings such as museums, libraries and research facilities.
  .3 Initial EFVM scan and leak locate system is required for all inverted roof assemblies.
  .4 Active (or monitored) roof leak detection systems must have the capability of issuing email alerts complete with a graphic of the roof indicating the location of the leak and must also be capable of issuing alarms to the BMS system.
  .5 The roof leak detection system can be hard wired or connected via BACnet to the UBC BMS system. Project team to coordinate with the UBC BMS group.
.19 Roof level access path
  .1 Install walkway paths at areas requiring regular maintenance, and from there leading to the main roof access door.
.20 Water retention/detention
  .1 Roofing components, provide both retention AND temporary water detention capacity, targeted at peak outflow reduction but to a limited capacity. If additional water retention/detention is being reviewed for a project for green roofs, selection should be determined by a combination of water retention and/or detention targets, weightbearing capacity, irrigation needs and use of specialized components targeted for water retention/detention within the green roof assembly.
  .2 Above evaluation to be done by the project team and shared with the Sustainability Department (C&CP) and UBCV Technical Review Team Architect.
.21 Basis of design details
  .1 Refer to the basis of design details provided as a starting point for green roof assembly design.
  .2 CRP to use these details for coordination of green roof details with the landscape architect.

2.2 Performance Requirements

.1 Life Cycle Expectation
  .1 Minimum 25-year service life expectancy

3.0 MATERIALS

3.1 Product Selection

.1 Inverted Roof Assembly – Membrane - refer to Section 07 10 00, 3.0 for requirements of this system. Basis of design details have been provided for reference at the end of this section.
.2 Conventional Roof Assembly – refer to Section 07 50 00, 2.2 for requirements of this system.
.3 Vegetation
  .1 Due to the permanent nature of green roofs, it's suggested that vegetative selection includes a majority of perennial coverage, unless design intent stipulates otherwise, like in the case of rooftop agriculture. Vegetation can be installed as seeds, cuttings, plugs, shrubs, trees, or pre-vegetated mats.
  .2 Vegetative selection should be determined by a combination of factors including but not limited to climate, growing media depth, growing media composition, design intent, irrigation, and maintenance requirements.

.4 Growing Media
- .1 Contact the manufacturer's representative to help determine the right growing medium composition for the green roof vegetation. Its recommended that an irrigation system be installed and maintained in good condition to sustain water needs throughout wet and dry seasons.
- .2 Growing media selection should be determined by a combination of factors including, but not limited to, depth of the assembly and vegetative choice. Growing media depth influences both water retention capacity, irrigation requirements, and overall weight. Vegetated roofing assembly growing media, in general, should have higher porosity, lower organic content, and higher mineral aggregate content than typical soil blends.
  - .1 Non-Irrigated Extensive and Semi-Intensive Systems
    Growing medium consisting of an unconsolidated mixture of organic matter and mineral aggregates. The composition is specially formulated by the vegetated roofing system manufacturer for extensive or semi-intensive systems, to provide optimal water retention, permeability, structural stability and density for plants with low water needs.
  - .2 Irrigated Semi-Intensive and Intensive Systems
    Growing medium consisting of an unconsolidated mixture of organic matter and mineral aggregates. The composition is specially formulated by the vegetated roofing system manufacturer for semi-intensive and intensive systems, to provide optimal water retention, permeability, structural stability and density for plants with medium and high water needs.

.5 Retention and/or Retention + Detention
- .1 Water retention capacity can be enhanced through specialized components targeted at water retention. Alternatively, roofing components, provide both retention AND temporary water detention capacity, targeted at peak outflow reduction.
- .2 Additional water retention/detention selection should be determined by a combination of weightbearing capacity, irrigation needs, and any water retention and/or detention targets.

.6 Filter Fabric
- .1 Filter fabric selection should aim to limit breaks and stabilize the growing media to prevent it from infiltrating other system components.

.7 Edging
- .1 Edging selection should be determined by growing media depth, durability, design asthetics, and water flow needs. Metal edging should be, at minimum, as high as growing media depth, and in areas with high water flow rates, should be perforated.

.8 Vegetative free zone ballast
- .1 Ballast selection should be determined by a combination of design aesthetics, weightbearing capacity, maintenance, and any wind uplift requirements. In general, either concrete pavers, or rounded river stones between sizes of 19mm and 38mm are recommended.

.9 Drain Mat
- .1 Consult warranty provider requirements for need and use of a second drain mat layer.
- .2 Drain mat selection should be determined by a combination of compressive strength, water flow rate, and roof assembly needs. For protected membrane assemblies, an open diffusion drain mat is required, laid overtop of the insulation layer. For conventional roofing assemblies, either an open diffusion or dimple drain mat is acceptable, laid over top of the root barrier.

.10 Root Barrier
- .1 :20 Mil polypropylene sheets are required in extensive systems due to shallow vegetative root systems and, in the case of pre-vegetated mats, reduce the likelihood of volunteer species becoming established. 30 Mil polypropylene sheets are requiredin non-extensive systems with more aggressive vegetative root penetration, and/or that have a higher likelihood of volunteer species establishment.

.2 Root barrier selection should be determined by a combination of vegetative choice, site conditions, and maintenance planning.

4.0 MAINTENANCE REQUIREMENTS

.1 Maintenance is required before, during, and after install of the vegetated roof system. Special consideration should be paid to irrigation, weeding, pest control, and fertilization needs of the vegetated roofing sections. Furthermore, regular cleaning of debris from drains and vegetation free zones is required.

.2 Intensive systems will generally require a higher degree of maintenance than extensive systems. Likewise, a sedum mat component will have a shorter establishment period than most perennials and shrubs. Consult with the Landscape Architect, Municipal Services when developing a maintenance program best suited to roof typology and vegetative selection.

.3 A maintenance program should be developed to include, at minimum, limited conditions for vegetation care, before, during, and after handoff to Facilities. Furthermore, it should include special conditions for the establishment period of the vegetation. Lastly, it should include long term conditions for both vegetative care, drain cleaning, and regular roof maintenance.

.4 The first two-year establishment period for the vegetated system generally requires higher frequency maintenance visits than subsequent years.

.5 Maintenance is a requirement of many warranty conditions, thus should be designed, at minimum, to meet warranty conditions.

5.0 LESSONS LEARNED AND COMMON MISSES ON UBC PROJECTS

Items in this section are lessons learned, and may be code or industry best practices which have been missed on past projects. If not applicable to a project, a variance is not required.

.1 All green roof details, whether at roof level or at grade are to be coordinated with the landscape and civil design. Complete details showing the landscape build-up plus drainage are to be included within the architectural detail sheets or booklet. The architectural site plan should coordinate drainage slopes and methods with the landscape and civil designs.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

1. Section 07 00 10 Building Envelope - General Requirements
2. Section 07 21 00 Thermal Insulation
3. Section 013300 Submittal Procedures
4. UBC LEED Implementation Guidelines
5. UBC Energy Modelling Guidelines
6. Owner's Project Requirements

1.2 Related External Documents

1. Latest edition of the British Columbia Building Code (BCBC).
2. RCABC Roofing Practices Manual.
3. Roof covering to conform to CAN/ULC-S107-M "Standard Methods of Fire Tests of Roof Coverings" for a Class A, B or C classification.
4. CSSBI-S8 "Quality and Performance Specification for Pre-Finished Sheet Steel Used for Building Products".
5. ASTM-A924/A924M "Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process".
6. CSSBI-20M "Standard for Sheet Steel Cladding for Architectural Industrial and Commercial Building Application
7. CAN/CGSB-1.171 "inorganic Zinc Coating".
8. ASTM-A653/A653M "Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process."
9. AAMA 621

1.3 Description

1. Work includes sheet metal roofing, anchoring methods and fasteners.
2. In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
3. These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
4. The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.

1.4 Coordination

1. The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
2. In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
3. These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
4. The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.

1.5 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures

.2 O&M Submittals

.1 Manufacturers Safety Data sheet (MSD) for all toxic or potentially toxic materials.
.2 Environmental Product Declaration (EPD).
.3 Shop drawings (including all structural and enclosure interface details) sealed and signed by a professional Engineer.
.4 Manufacturer performance test data to confirm performance criteria.
.5 Maintenance Data
  .1 As-installed hardware.
  .2 Source for replacement parts.
  .3 Maintenance instructions.

1.6 Quality Control and Assurance

.1 Quality Assurance
  .1 Meet or exceed the RoofStar Guarantee 5-Year guarantee standards All roofing system products to conform to the RoofStar Guarantee Standards and to the appropriate CSA, CGSB, ULC, CULC, and ASTM Standards for the materials used in the roofing system; products to be listed in the RGC Accepted Materials List of the RoofStar Guarantee Roofing Practices Manual, and to be in conformance with the manufacturers' published product and performance data.
.2 Quality Control
  .1 An Independent Inspection Agency acceptable to RoofStar Guarantee, and assigned by RoofStar Guarantee on acceptance by the Consultant and the UBC Development Manager, to conduct field review inspections as per the minimum protocols as set forth by the RoofStar Guarantee for their 5 Guarantee Program. It is understood that in addition to these responsibilities the independent inspection agency will provide re-inspection services at the 2 year anniversary – in the case of the 5 year warranty.
    .1 Cost for the warranty and inspections are to be included in the contract sum.
  .2 UBC reserves the right to increase the field review inspection frequency to FULL TIME site inspections while the work is in progress. Extra costs for this to be borne by UBC.
  .3 Added inspections just prior to the expiration of the warranty, if required, will be arranged and the costs borne by UBC
  .4 A manufacturer’s representative to also inspect the work as required for the purposes of providing the manufacturer’s labour, material and workmanship warranty upon completion.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 Roofing is to be designed to meet Guarantee Standards of the Roofing Contractors Association of British Columbia Guarantee Corp. (RGC) as published in the "RGC Roofing Practices Manual" for a 5-Year guarantee.

.2 Design roof system to accommodate thermal movement of the roof sheet caused by ambient temperature.

.3 Use exterior insulated assemblies whenever insulated roof assemblies are utilized.

.4 Use thermal clips or bearing plates to provide a thermally efficient assembly and structurally support the roofing system.

.5 Design roof system to withstand as a minimum dead loads, seismic, movement, wind load, snow loads, snow build-up and rain load as required by the BCBC. Signed shop drawings by an professional engineer registered in BC is required.

.6 Sheet metal roofing systems are to be concealed fastener type.

2.2 Performance Requirements

.1 The design service life of sheet metal roofs is 30 years to first major maintenance/ replacement.

.2 The air barrier system in sheet metal roofing systems is to function as a secondary drainage plane. All fastener penetrations are to be sealed and clamped, and the air barrier plane is to be water tight over the design service life of the roofing.

.3 Sheet metal roofs must be designed to consider potential snow slumping hazards. Snow retention stops or clips must be incorporated into roof slopes where there is the potential for injury to the public from sliding snow.

.4 Energy targets for new projects and major renovations are developed to reduce UBC's energy use over time and support UBC's Climate Action Plan (CAP 2030). Coordinate with Section 07 21 00 Thermal Insulation for effective R value of insulation for both new and re-roofing assemblies. The effective R value of insulation is to be measured at 0°C. For new roofs, it is recommended to exceed the minimum requirements of the latest version of the BC Building Code.

.5 Thermal bridging effects shall be accounted for, evaluated and provided identifying how thermal bridging will be mitigated to meet overall effective thermal performance requirements. Refer to Section 07 21 00, 2.2.4 for techniques to be used.

3.0 MATERIALS

3.1 Product Selection

.1 Sheet metal roofing is to be a minimum 0.71 mm thick (24 ga), Z275 (G90) galvanized. Prefinished metal work to have AAMA 621 two-coat fluoropolymer coating not less than 70% PVDF..

.1 Series 10000 paint finish by ArcelorMittal or equivalent applied over galvanizing.

.2 Kynar 500

.2 Selection of other sheet metal roofing systems should include service life and maintenance considerations in addition to design considerations. A variance will need to be granted for alternate options. The variance request should include design and performance comparisons.

.3 Sheet metal accessories for low slope roofs are to be a minimum 0.71 mm thick (24 ga), Z275 (G90) galvanized. Prefinished metal work to have Series 10000 paint finish over galvanizing or equivalent.

.4 Insulation to be rockwool or polyisocyanurate types.

.5 Metal work concealed in the roof assembly is to be at a minimum 18 ga Z275 (G90) galvanized sheet metal, protected with a bituminous coating where in contact with damp materials.

.6 Air barrier/roof underlay membrane systems considered to have adequate design service lives for use under sheet steel roofing systems are:

.1 Single ply polyester-reinforced torch applied SBS modified bitumen roofing membrane; fully reinforced 180g felt weight.

.2 Some high melting point, adhesively applied bitumen membranes, fully reinforced 180g weight.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 Section 06 10 00 Rough Carpentry
.2 Section 07 00 10 Building Envelope – General Requirements
.3 Section 07 10 00 Damproofing and Waterproofing
.4 Section 07 40 00 Cladding
.5 Section 07 50 00 Membrane Roofing
.6 section 07 61 00 Sheet Metal Roofing

1.2 Related External Documents

1. RCABC Roofing Practices Manual.
2. Fabricate to SMACNA (Sheet Metal and Air Conditioning Contractor's National Association) – Architectural Sheet Metal Manual Standards.
3. CSSBI-S8 "Quality and Performance Specification for Pre-Finished Sheet Steel Used for Building Products".
4. ASTM-A924/A924M "Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process".
5. CAN/CGSB-1.171 "inorganic Zinc Coating".
6. ASTM-A653/A653M "Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process."

1.3 Description

1. Section includes sheet metal flashing and trim for wall and roof assemblies.

1.4 Coordination

.1 The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
.2 In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
.3 These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
.4 The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.

1.5 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures.

.2 Provide samples for colour selection only if it is a Construction Office project.

.3 O&M Submittals
  .1 Product specifications, type and colour.
  .2 Environmental Product Declaration (EPD).
  .3 Final reviewed shop drawings (including all enclosure interface details).
  .4 Manufacturer performance test data to confirm performance criteria.
  .5 Maintenance Data
    .1 Source for replacement.
    .2 Maintenance instructions.

1.6 Quality Control and Assurance

.1 Quality Assurance
- .1 Refer Sections 07 40 00 Cladding,07 50 00 Membrane Roofing and 07 61 00 Sheet Metal Roofing.
- .2 Follow all recommendations of the "RGC Roofing Practices Manual", as a minimum.
- .3 Include flashings in mockups as specified for work of other sections.

.2 Quality Control
- .1 Refer Sections 07 40 00 Cladding, 07 50 00 Membrane Roofing and 07 61 00 Sheet Metal Roofing.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 Meet the guarantee standards of the Roofing Contractors Association of British Columbia Guarantee Corp. (Roofstar Guarantee) as published in the "RGC Roofing Practices Manual" for a 5-year guarantee.

.2 Provide sheet metal in base metal thickness specified. Where no thickness is specified, provide base sheet metal in thickness recommended in SMACNA Architectural Sheet Metal Manual for type of item being fabricated, but not less than 24 gauge thickness for all installations.

.3 Zinc coated steel sheet: 24 gauge thickness minimum, commercial quality to ASTM A653/A653M, with Z275 (G90) designation zinc coating.

.4 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 33 with AZ150 coating, regular spangle surface, 24 Gauge base metal thickness.

.5 Provide continuous clip-type fasteners at all parapet flashings, of same material as flashing.

.6 Provide 19mm (¾”) high standing seam or 1” pocket S-Lock joints between flashing section

.7 Provide overflow scuppers whenever perimeter walls exceed 100 mm (4") in height, to BC Building Code requirements. Refer to SMACNA Appendix A-7, Scupper Sizing.

.8 Fabrication shall be standing seams only at inside and outside corners, provide S-lock at all other locations

.9 Apply isolating coating to all metal surfaces in contact with cementitious materials.

.10 Avoid the use of reglets as roof membrane terminations.

.11 Avoid surface fasteners.

.12 Provide a minimum of 10% slope at all flashings.

.13 Cap flashings to extend a minimum of 10mm beyond the face of the walls to avoid drip lines.

3.0 MATERIALS

3.1 Product Selection

.1 Base metal for sheet metal accessories and for sheet metal flashing and trim to be:
- .1 Zinc coated sheet steel conforming to the requirements of ASTM A653 (or A653M as applicable) with a minimum zinc coating of G90 (Z275), or
- .2 Prefinished steel sheet with coating system consisting of base metal with factory applied pre-treatment, primer, and fluoropolymer (PVDF) topcoat meeting requirements of CSSBI S8.
  - .1 Finished colour finished on both sides.
  - .2 Exposed coating thickness: dry film coating system thickness not less than 22 micrometres.
  - .3 Flashing should be humidity, salt spray and chalk resistant.
- .3 Aluminium-zinc coated (Galvalume) steel sheet conforming to the requirements of ASTM A792 (or A792M) with a minimum coating of AZ50 (AZM150) or
- .4 Aluminum sheet conforming to CSA HA Series1975, plain:
  - .1 Generally minimum 0.81 mm (20 gauge), 1.02 mm (18 gauge) at parapets and flashings 200mm (8") width or wider.
- .5 Minimum 24 gauge thickness.

.2 Provide sheet metal in base metal thickness specified. Where no thickness is specified, provide base sheet metal in thickness recommended in SMACNA Architectural Sheet Metal Manual for type of item being fabricated, but not less than 24 gauge thickness for all installations.

.3 Zinc coated steel sheet: 24 gauge thickness minimum, commercial quality to ASTM A653/A653M, with Z275 (G90) designation zinc coating.

.4 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 33 with AZ150 coating, regular spangle surface, 24 Gauge base metal thickness.

.5 Flashing used in contact with treated wood must be compatible with the treated wood and last long enough to be suitable for the intended application. Flashing must also be of the same type of metal as any fasteners that penetrate through them to avoid galvanic corrosion.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 Section 07 00 10 Building Envelope – General Requirements (for roof safety requirements)
.2 Section 07 50 00 Membrane Roofing
.3 Section 07 62 00 Sheet Metal Flashing and Trim

1.2 Related External Documents

1. RCABC Roofing Practices Manual.
2. WorkSafe BC OHS Regulations.

1.3 Description

1. Roof hatches and service ladders.

1.4 Coordination

1. The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
2. In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
3. These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
4. The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.

1.5 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures

.2 O&M Submittals
  .1 Product specifications, type and anchoring methods.
  .2 Shop drawings *(including all interface details)* sealed and signed by a Professional Engineer registered in the Province of British Columbia.
  .3 Manufacturer performance test data to confirm performance criteria.
  .4 Manufacturers Safety Data sheet (MSD) for all toxic or potentially toxic materials.
  .5 Maintenance Data
    .1 As-installed hardware.
    .2 Source for replacement parts.
    .3 Maintenance instructions

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 Roof Hatches
  .1 Roof hatches are acceptable only in the following circumstances:
    .1 Roofs with **no rooftop equipment** requiring maintenance may be accessed using an internal *ship's* ladder and roof hatch, size 3'-0" x 2'-6", insulated integral curb and flashing, c/w externally mounted safety grab handle and non-removable pin (NRP) hinges.
    .2 Roofs having **rooftop equipment requiring occasional maintenance** may be accessed using an internal ship's ladder) and roof hatch, size 2'-6" x 4'-6" *or a service stair* and roof hatch size 2'-6" x 8'-0". Hatch to have insulated integral curb,

and flashing, externally mounted safety grab handle *and* non-removable pin (NRP) hinges.

.3 **UBCO only** – Roof hatches are to be supplied with guards around roof hatches. These are to be a permanent (side-mounted and bolted) OSHA and Worksafe compliant roof hatch guardrail system with a self-closing safety gate.

.2 Roof Ladders

.1 Roofs having rooftop equipment requiring regular maintenance or to a penthouse at roof level are to be accessed via a stairway extending to the roof or through provision of a ladder. Roof ladder design to be as follows:

.1 Only ship ladders are acceptable. A variance will need to be granted for the use of vertical ladders.

.2 Ladder dimensions to be as per WorkSafe BC standards. Treads are not to overlap over one another. The beginning of each tread should align with the end of the tread below.

.3 Ships ladder slope should not exceed 60 degrees.

2.2 Performance Requirements

.1 Roof hatches and ladders to conform to WorkSafe BC OHS requirements and standards.

3.0 MATERIALS

3.1 Product Selection – NOT USED

3.2 Finishes

.1 Roof hatch guardrail to be of anodized aluminum or galvanized steel.

.2 Standard exposed ladder finish: Galvanized steel.

4.0 LESSONS LEARNED AND COMMON MISSES ON UBC PROJECTS

Items in this section are lessons learned or misses from past projects. These may also include code or industry best practices. If not applicable to a project, a variance is not required.

.1 Recent ships ladders installed on new builds have been unusable from a safety perspective. Based on design modifications done after installation to increase tread overlap, design requirements have been updated as noted above.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 Section 07 00 10 Building Envelope – General Requirements
.2 Coordinate with firestopping requirements in Divisions 21, 26 and 27.

1.2 Related External Documents

1. Latest edition of the British Columbia Building Code (BCBC).
2. CAN/ULC S115-11, "Standard Method of Fire Tests of Firestop Systems".
3. ULC List of Equipment and Materials:
   .1 ULC or cUL listed firestop assemblies for intended application.

1.3 Description

1. Firestopping systems as required by architectural, mechanical and electrical disciplines.

1.4 Coordination

.1 The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
.2 In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
.3 These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
.4 The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.

1.5 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures.

.2 O&M Submittals
   .1 Shop drawings/ product sheets indicating location of firestopping, and ULC/cUL listings.
   .2 Tag service penetrations and every 3.0 meters of joint seal with printed tags indicating name and phone number of subcontractor and the following statement: "CAUTION! FIRESTOP: DO NOT RE-ENTER, PUNCTURE OR DESTROY UNLESS PREPARED TO RE-SEAL IMMEDIATELY WITH PROPER, ULC-APPROVED METHOD. ALL NEW WORKS SHALL BE REVIEWED BY UBC PERMITS & INSPECTIONS."
   .3 Manufacturer performance test data to confirm performance criteria.
   .4 Manufacturers Safety Data sheet (MSD) for all toxic or potentially toxic materials.
   .5 Environmental Product Declaration (EPD).
   .6 Maintenance Data
   .7 Method for replacement of the firestopping system.
   .8 Maintenance instructions

1.6 Quality Control and Assurance

.1 Quality Assurance
   .1 Ensure that other sections are aware of the maximum and minimum clearance requirements to the penetration stipulated by the Underwriter's design listing.
.2 Quality Control
   .1 Installer to be certified by product manufacturers for installation of products, including for safety and so as to ensure warranties are not affected.
   .2 Do not mix products in the system from differing manufacturers.
   .3 Use the same product for all like applications.

.3 Commissioning
.1 Prior to occupancy and during demonstration and training for UBC maintenance crews, provide a comprehensive seminar to UBC's mechanical and electrical staff on the purpose and nature of the firestop systems used. Include a demonstration with "hands-on" session on re-entry, re-sealing and all safety aspects of the firestops.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 Firestopping to be designed to act as a firestop and smoke seal within fire-resistive wall and floor assemblies for any penetrating items such as cables, cable trays, conduits, ducts, pipes orc any poke-through termination devices, such as electrical boxes along with their means of support through the wall or floor opening.
.2 Provision of firestopping materials at fire-resistive wall and floor assemblies such as joints at intersections of dissimilar construction.
.3 Systems that have Environmental Product Declarations (EPD) are preferable.

2.2 Performance Requirements

.1 Firestopping performance requirements to be as per the approved ULC or cUL system for the intended application.

3.0 MATERIALS

3.1 Product Selection

.1 General firestopping products manufactured by Hilti (Canada) Limited. Other major firestopping manufacturers are acceptable as long as the ULC listed firestopping system is properly installed and will suffice to satisfy the latest edition of the BC Building Code.
.2 Zone pathways for Division 27 – specifically use Hilti CFS-SL GP system. Due to the nature of IT cables and how they are installed and re-installed, UBC IT has expressed a preference for this particular system as it allows the most future flexibility and cost effectiveness while maintaining the most effective fire barrier over time and penetration re-entry, in particular the speed sleeve product preference at this time.
.3 UBC Project Manager/ Construction Office to coordinate review of the installed firestopping systems with UBC Permits & Inspections for compliance with the approved ULC listing.
.4 Use low VOC products.
.5 Use primers whenever recommended by manufacturer.

*****END OF SECTION*****

1.0 GENERAL

1.1 Related Work and UBC Guidelines

.1 Section 03 33 00 Architectural Concrete
.2 Division 7 – related sections therein
.3 Division 8 – related sections therein
.4 UBC Resilience-Based Design Guide for Nonstructural Systems

1.2 Related External Documents

1. Latest edition of the British Columbia Building Code (BCBC) – where applicable.

1.3 Description

1. Section includes joint sealants used in wall assemblies, around windows and doors (interior and exterior), including within curtainwall and storefront systems.

1.4 Coordination

1. The Guidelines apply to all work completed within buildings on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
2. In instances where conflicts are found between these guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
3. These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
4. The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.
5. The CRP is to develop envelope details and select sealants so as to obtain high performance, durability, and low-maintenance details. Details are to be reviewed by a building envelope consultant.

1.5 Submittals

.1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures

.2 O&M Submittals
  .1 Shop drawings (including all enclosure interface details) sealed and signed by a professional engineer registered in the Province of BC.
  .2 Product data and specifications, type and colour, manufacturer and distributor name.
  .3 Environmental Product Declaration (EPD).
  .4 Manufacturers Safety Data sheet (MSDS) for all toxic or potentially toxic materials.
  .5 Manufacturer performance test data to confirm performance criteria.
  .6 Maintenance data and instructions.
  .7 Warranties - applicable extended warranties for each product as offered by sealant manufacturers.

1.6 Quality Control and Assurance

.1 Quality Assurance
  .1 Installation by trade contractor who specializes in the application of sealant systems.
  .2 Incorporate quality assurance programs in the contract documents particular to the project and developed in concert with manufacturers and suppliers of this trade, and the envelope consultant.

2.0 DESIGN AND PERFORMANCE REQUIREMENTS

2.1 Design Requirements

.1 Proper joint design to be reviewed, especially with regard to sealant movement.

.2 All joints to receive sealant shall be designed to be 4 times as wide as the anticipated movement. This should include movement due to thermal expansion and contraction as well as structural movement. This is of particular importance at window and door frames.

.3 Sealants selected on a project should be compatible with adjacent surfaces that they come into contact with.

2.2 Performance Standards

.1 Only high-performance elastomeric sealants are to be used. Sealants must be capable of withstanding dynamic movement in exterior applications for long periods of time (typically 20+ years).

.2 Durability of sealants is important, especially when considering the service life of the building.

3.0 MATERIALS

3.1 Product Selection

.1 Exterior weather seal sealants shall be high performance neutral cure silicone with excellent adhesion to both porous and non-porous surfaces, high movement capability and excellent weatherability. Acceptable products are : Dow Corning 991, 790 and 795 or GE SILPRUF and GE SILPRUF NB.

.2 Use non-staining sealants for sensitive substrates such as stone unless testing has been done to ensure compatibility and use of regular sealants.

4.0 LESSONS LEARNED AND COMMON MISSES ON UBC PROJECTS

Items in this section are lessons learned, and may be code or industry best practices which have been missed on past projects. If not applicable to a project, a variance is not required.

.1 UBC experiences continual failures in exterior caulking around door and window frames, louver frames, in cladding joints and other areas of non-movement. Consequently, joint sealants are not to be used as a primary method of waterproofing or shedding water. Appropriate penetration details complete with flashing and counter flashing to be provided.

*****END OF SECTION*****