

5.3 Roofing

5.3.1 General Requirements for All Roofing Types

1. See also Section 4 – Performance Requirements, 5.5.2 Thermal Insulation, 5.5.3 Air Barrier, and Appendix E Confined Space & Fall protection
2. Coordinate design with Building Envelope Consultant.
3. All roof drainage to be coordinated with the UofC Storm Water Goals. Where roof drainage is to grade, locate outlets and interior drainage pipes which discharge to the outside at a location sufficiently above grade so as to preclude damming and backup into the building. Where drainage is not to be handled on site, rain water leaders are to be taken through the interior and tied to the storm sewer system.
4. Avoid use of scuppers except as emergency overflow devices.
5. When light is to be introduced through the roof, use vertical clerestory glazing or roof monitors in lieu of skylights and sloped glazing. Skylights and sloped glazing are PROHIBITED as these systems frequently become building envelope problems, triggering significant operation and maintenance costs to the University.

5.3.2 Low-sloped Roofing

5.3.2.1 General Requirements

1. See also 4.1 – Institutional Sustainability, 5.2.2 Thermal Insulation, 5.2.3 Air Barrier, and 7.1.2 Fall protection
2. Coordinate design with Building Envelope Consultant.
3. Roofing system to include 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. In addition to the above 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.
4. Roofing is to be designed to meet Guarantee Standards of the Alberta Roofing Contractors Association (ARCA) as published in the ARCA Roofing Application Standards Manual for a 10-year guarantee.
5. 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.
6. Roofing is to be designed to minimum Factory Mutual wind uplift standards, Class 1-90 windstorm.
7. New and re-roof assemblies shall have a minimum of 2% slope "to drain".
 - a. This can be achieved by structural slope, sloped insulation, cricket and back slopes or any combination of these.

- b. Gypsum board sheathing or plywood attached to metal deck using adhesive or mechanical fastener can be used as an auxiliary leveling surface.
 - c. Slope all roof surfaces to drains including valleys and transverse slopes across top of parapets.
 - d. Use internal roof drain systems with open flow drains and minimum 100 mm pipes. Avoid the use of control flow drains.
 - e. Use a minimum of two roof drains per contained drainage area. For minor roof areas use of scuppers may be considered.
 - f. Provide overflow scuppers or emergency roof drain located approximately 150 mm vertically upslope from the main drain and leaded directly outside.
 - g. Where a lower roof is impacted by flow from upper roof conditions, ensure design accommodates the increased volume and structural loading factors.
 - h. When cast-in-place concrete top surface is unavoidable, special design considerations for drainage, venting and placing of concrete are necessary.
 - i. Deviation from this requirement must be obtained from UofC FM&D in writing prior to design. 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.
8. The design service life of low-sloped roofs is to be a minimum of 25 years.
 9. UofC's required roof assembly type for low slope roofing is fully adhered exposed membrane systems (conventional - not inverted roofs) to allow for regular inspection and maintenance of roof stock. (See 5.8.2.3 below).
 10. The installation of concrete or asphalt topping over membrane roofing is not permitted without prior approval and written confirmation from UofC FM&D.
 11. In the case of waterproofing (as opposed to roofing) assemblies where the use of 2 ply SBS modified asphalt sheet membranes are not appropriate, use manufacturer guaranteed waterproofing systems specifically designed for this purpose, such as products conforming to CGSB-37.50, Standard for "Asphalt, Rubberized, Hot Applied, for Roofing and Waterproofing" and/or current relevant standards.
 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 envelop 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. Insulation is to be mopped, adhered, and or mechanically fastened as required to meet wind uplift standards, manufacturer and warranty requirements and as appropriate to the configuration of the building.
 14. Insulation overlay board is to be installed over the insulation and under the roof membrane despite manufactures minimum standards that do not require it.

15. Roofing membranes are to be mopped, fully adhered, or torched applied 2 ply SBS modified bitumen membrane. PVC roofing membranes may be used in some circumstances. Alternative membranes are not permitted. Choice of roofing membrane to be reviewed and approved by FM&D.
 - a. In the case of re-roof construction, UofC requires the use of systems and assemblies that do not require the use of hot asphalt, kettles or tankers. New work can utilize hot asphalt, kettles or tankers by the virtue of the fact that the projects are designated construction sites as opposed to isolated on campus sites associated with re-roofing.
 - b. Roofing membrane to incorporate manufacturer applied warranty-approved reflective coating or integral reflective treatment.
16. Drains
 - a. For new construction all drains shall be cast iron and include all appropriate hardware.
 - b. 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.
 - c. All cast drains shall utilize lead sheets when sealed in. In new construction the lead sheet is supplied by the plumbing trade. In re-roofing the roofer supplies the lead sheet.
 - d. All drain baskets, strainers or screens shall be cast iron or aluminum, plastic will not be permitted.
 - e. The use of drain inserts will only be considered when dictated by building configurations or circumstance. Written permission is required from UofC FM&D prior to design. 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.
 - f. All drains are to be sumped with sumps turned 45° 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. The cap stripping is to extend up past base sheet and is to obtain a separate seal to the substrate.
 - a. All stripping plies shall be mechanically terminated to the substrate at least 200 mm above the roof surface.
 - b. Top edges of membranes are to be protected by counter flashings.
 - c. In new construction reglets will be installed to allow for the installation of membrane plies and or flashings. Gumlip flashings will not be permitted.
 - d. In re-roofing 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 ARCA Roofing Application Standards Manual detail.

19. Where a roof joins a wall that is extending above the roof, locate wall cladding, windows, doors, louvres and other wall penetrations a minimum of 300 mm above the top surface of the roof.
20. Roofing connections to walls are recommended to be designed as protected membrane transitions in both conventional and protected membrane designs.
21. See sections on Wall Cladding Systems for other detailing requirements of air/vapour barrier and insulation systems.
22. Maintain a practicable constant elevation around the perimeter of the contained roof area. If a varying perimeter cannot be avoided, provide dimension details of low and high edge conditions.
23. Provide curbs minimum 200 mm above the roof membrane level for all penetrations. Locate raised equipment so that they do not impede drainage and have minimum 1m clearance around and under to allow for roof application.
24. All roof furniture to be mounted on curbs at least 100mm above scupper level.

5.3.2.2 Quality Control and Assurance

1. Quality Assurance - Meet or exceed the ARCA 10-Year guarantee standards. All roofing system products to conform to the ARCA 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 ARCA Accepted Materials List of the ARCA Roofing Application Standards Manual, and to be in conformance with the manufacturers' published product and performance data.
2. Quality Control - An Independent Inspection Agency acceptable to ARCA, and assigned by ARCA on acceptance by the Consultant and the UofC Project Manager, to conduct field review inspections as per the minimum protocols as set forth by the ARCA for their 10 year Guarantee Program. It is understood that in addition to these responsibilities the independent inspection agency will provide re-inspection services at the 2.5 and 8 year anniversaries in the case of the 10 year warranty.
 - a. Cost for the warranty and inspections are to be included in the contract sum.
 - b. The UofC 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 born by the UofC.
 - c. Added inspections just prior to the expiration of the warranty, if required, will be arranged and the costs born by UofC.
 - d. 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.
3. Submittals
 - a. Manufacturer Product Data, including MSDS data, for each product proposed.

- b. Samples of membrane, flashings, cladding and/or pavers as required for color selection.
- c. Sloped insulation, cricket and/or back slope plan.
- d. Sheet metal flashing shop drawings.
- e. Manufacturer's leakproof warranty sample.
- f. WCB clearance letter.
- g. Manufacturer's confirmation of training.
- h. Fastening patterns and sheet layout for mechanically attached membrane assemblies.

4. Warranties

- a. Provide the ARCA System Approval Form, to include the ARCA standard 10-Year Guarantee, copies of Inspection Reports, listing and literature of all products used, and Roof Maintenance Guide.
- b. Provide a written and signed Membrane Manufacturer's Warranty in the name of the UofC. The warranty is to include for removal and replacement of the defective membrane including labour, for a non-prorated ten-year period. The membrane warranty is not to be limited by other components that are only available or manufactured by the membrane manufacturer. Letters modifying the manufacturer's standard warranty are not acceptable.
- c. Provide the manufacturer's labour, material and workmanship warranty, and leakproof warranty for a period of 10 years.
- d. Where adhesive is used in the assembly, include and provide the adhesive manufacturer's warranty.
- e. All warranties to commence at Date of Substantial Performance.

5.3.2.3 Materials

1. Minimum 25-Year service life expectancy
2. The preferred System at Low-Slope Roofs is a 2-Ply SBS Bituminous Modified Flexible Membrane Roofing System, exposed, insulated, adhered, generally torch-applied. Refer to the ARCA Roofing Application Standards Manual for this system. Note that a PVC Membrane System may also be an acceptable alternate in some circumstances.
3. Thermal barrier/underlay at steel deck where required: shall be minimum 1/2 inch gypsum board or 1/4 inch Fiberglass reinforced gypsum board (dens deck). Note that a thermal barrier is not required with polyisocyanurate insulations but is required with all other types of insulation.
4. Vapour retarder is required on all roofing assemblies and shall be SBS modified bitumen sheet. Co-ordinate installation and connection of roof vapour retarder to wall vapour retarder.

5. 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.
6. Concrete decks shall receive primer as prescribed by the membrane manufacturer. Preferred membrane application shall be fully adhered and torch applied.
7. 2 ply #15 felt installed on a primed concrete deck in full moppings of hot type III asphalt with a #30 glaze coat is an acceptable vapour retarder for new construction only.
8. Insulation overlay shall be 1/4" inch or 1/2" inch "Dens Deck" or equivalent and be adhered or mechanically attached through to the substrate as determined by the substrate and the requirements of the assembly.
 - a. Fiberboard or perlitic overlays installed in full moppings of hot type III asphalt are acceptable for new construction only.
 - b. Note that 2 (two) layers of insulation overlay are required when installed over heat sensitive insulations.
9. Roof insulation shall achieve a minimum value of R40 for both new and re-roof assemblies, also note that roof assembly must meet performance targets established at onset of project:
 - a. Insulation for use in conventional assemblies, the preferred roofing configuration, is polyisocyanurate.
 - b. Type I and II EPS (expanded polystyrene) insulations are not permitted for any roofing installation.
 - c. 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.
 - d. 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).
 - e. 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.
 - f. Secondary Insulation to be used as required, to consist of wood fibreboard with thickness as determined by the type of primary insulation used and meeting current relevant CAN Standard (ex: CAN/CGSB A247-M86).
 - g. Attachment
 - i. Fasteners: minimum number of fasteners and stress plates for installation on wood or steel decks to be as specified by the ARCA Manual for 10 Year Guarantee standards and/or as required to Factory Mutual 1-90 whichever is greater.
 - ii. Adhesives: adhesive application rates when used in adhering insulations and coverboards on concrete decks shall meet or exceed the requirements of the ARCA, the manufacturer and Factory Mutual requirements for 1-90.

- The preferred adhesive for all assemblies is a two component polyurethane such as Insta-Stik by Dow Chemical or similar.
- Type III asphalt, as the assembly adhesive is only acceptable for new work.

10. Materials - miscellaneous

- a. Thermal insulation to meet PROPOSED (or adopted final when in effect) legislation for no CFC, HCFC, CFC compounds, both in neither manufacturing process nor the installed product.
- b. For plastic foam insulations, relevant current CAN/ULC Standard shall apply for establishing the required "R" value (known as LTTR "Long Term Thermal Resistance" value in this standard).

11. Components

- a. Install walkway pads 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.
 - i. Provide durable walkway materials as recommended by roofing system manufacturer.
 - ii. Walkway materials shall be placed to permit drainage of water to roof drains.
 - iii. Walkways to be either a reinforced walkway, cap sheet manufactured by the same manufacturer as the roof membrane, or 2'x2'x2" precast plain finish concrete paver slabs on pedestals (no substitutes such as duckboards or poured-in-place concrete).
 - iv. Install approx. 2" inch apart and away from cants and flashings, in a regular and uniform pattern.
 - v. Roof walkways shall be compatible with roof system guarantee.

12. Provide one overflow scupper per roof drain whenever perimeter walls exceed 100 mm (4") in height. Scuppers to be a minimum of 3" inches in diameter.

13. 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 caulking are not acceptable. 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.

14. Kitchen Exhaust Discharge Pans: Provide 22 ga galvanized metal protection pan to the perimeter of kitchen exhaust ducts to provide discharge protection to primary membrane installations.

5.3.2.4 Execution

1. All materials to be protected from the weather and elements with purpose made tarps and elevated from the ground or deck. Factory wrappings are not acceptable protection from the elements.
2. Install roofing only when weather conditions permit. Materials that become wet due to inclement weather shall be replaced with no expense to the Owner.
3. Install only as much material as can be rendered completely watertight by day's end, include for night seal and tie-ins as required to maintain the integrity of installed components.
4. In the case of reroofing the replacement roofing and building shall be sealed and rendered watertight by day's end.
5. In the case of reroofing all debris is to be disposed of with purpose made chutes. Debris is not to be thrown from the roof at any height.
6. All areas installed shall be completed to the base sheet and base sheet stripped daily.
7. Field cap sheet stripping shall follow base sheet installation within 48 hours.
8. Install Base and Cap membrane flashing over parapets and other locations before installing metal cap flashing.
9. On all UofC standard SBS roofing assemblies a water seal or water cut-off is required at approximately every 32' feet in either direction to create a grid pattern of watertight areas. It is understood that the insulation's offsets and staggers must be minimized or eliminated to accommodate the installation of the SBS water seal. The material to be used for the flap must be SBS, consistent detailing with other permanent details on the roof, tight up to the insulation of the roofed section, sealed to the base sheet layer and the vapour retarder with a standard 3" lap.
10. Avoid the use of gum pans.

5.3.3 Sheet Metal Roofing

5.3.3.1 General Requirements

1. Roofing is to be designed to meet Guarantee Standards of the ARCA as published in the Roofing Application Standards Manual for a 10-Year guarantee.
2. 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.
3. Roofing is to be designed to minimum Factory Mutual wind uplift standards, Class I90 windstorm.
4. Allow differential thermal movement between the panels and the purlins/joists throughout a temperature range of 100°C.
5. Sheet metal roofing systems are to be concealed fastener type.

6. The design service life of sheet metal roofs is 30 years to first major maintenance/replacement.
7. Metal roofs should be considered as water-shedding only. Provision of membranes below all metal roofing and flashings considering metal roofings and flashings as "water shedding" rather than "waterproofing". The air barrier system in a 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.

5.3.3.2 Materials

1. Insulation to be rockwool or polyisocyanurate types.
2. Sheet metal roofing is to be a minimum 0.71 mm thick (24 ga.), Z275 (G90) galvanized. Prefinished metal work to have Dofasco Series 5000 paint finish or equivalent applied over galvanizing.
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 Dofasco Series 5000 paint finish over galvanizing or equivalent.
4. Other sheet metal roofing systems to be approved by FM&D. If approved, other sheet metal roofing systems to be selected with design service life and maintenance considerations foremost.
5. Metal work concealed in the roof assembly is to be at a minimum 18 gauge Z275 (G90) galvanized sheet metal, protected with a bituminous coating where in contact with damp materials.
6. Metal work is to be provided with electrolytic isolation between dissimilar metals including fasteners.
7. Air barrier/roof underlay membrane systems considered to have adequate design service lives for use under sheet steel roofing systems are:
 - a. Single ply polyester-reinforced torch applied SBS modified bitumen roofing membrane; fully reinforced 180 g felt weight.
 - b. Some high melting point, adhesively applied bitumen membranes, fully reinforced 180 g weight.
8. Metal roofing shall be separated from the purlins/joists by continuous insulating thermal block with a minimum of 50 mm thickness, in addition to any insulation present.
9. Drainage shall be designed to prevent build-up of ice dams and icicles.

5.3.4 Sheet Metal Flashing & Trim

5.3.4.1 General Requirements

1. Coordinate design with Building Envelope Consultant.

2. Roofing is to be designed to meet Guarantee Standards of the ARCA as published in the Roofing Application Standards Manual for a 10-Year guarantee.
3. Fabricate to SMACNA Standards.
4. Follow all recommendations of the ARCA Roofing Application Standards Manual, as a minimum.
5. Samples for color selection must be submitted to FM&D for review and approval.

5.3.4.2 Materials

1. Metal flashings - minimum, thicknesses/gauges (exclude thickness of paint), finish coatings noted below.
 - a. Galvanized steel sheet conforming to ASTM792M with AZ180 Galvalum or equal alum/zinc coating. Generally minimum 0.65 mm (24 MSG gauge), 0.80 mm (22 MSG gauge) at parapets and flashings 200 mm (8") width or wider.
 - b. Aluminum sheet conforming to CSA HA Series-1975, plain. Generally minimum 0.81 mm (20 gauge), 1.02 mm (18 gauge) at parapets and flashings 200mm (8") width or wider.
 - c. Provide continuous clip-type fasteners at all parapet flashings, of same material as flashing.
 - d. Provide overflow scuppers whenever perimeter walls exceed 100 mm (4") in height, to AB Building Code requirements. Refer SMACNA Appendix A-7, Scupper Sizing.
 - e. Finishes shall be pre-finished coil coating to be 10,000 Series, Stelco, Defasco, Duranar, or equivalent.
 - f. Fabrication shall be standing seams only at inside and outside corners, S-Lock at all other locations.

5.3.4.3 Execution

1. Apply asphaltic coating to all metal surfaces in contact with cementitious materials.
2. Avoid the use of reglets as roofing membrane terminations.
3. Avoid surface fasteners.
4. Provide 10% slope towards roof at all parapets, min. 2% elsewhere.
5. Avoid the use of gum pans.

5.3.5 Roof Accessories

5.3.5.1 General Requirements

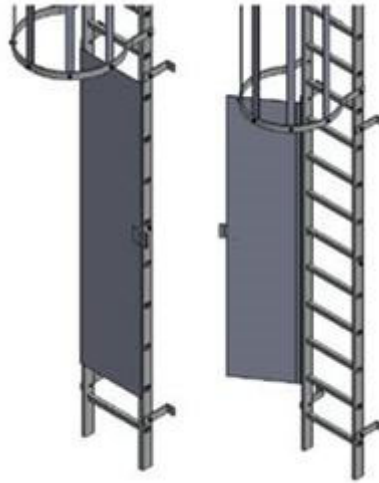
1. Coordinate design with Building Envelope Consultant.
2. Roof Access Hatches require submittal of Shop Drawings to FM&D.

5.3.5.2 Materials

1. All roofs to be provided with access from interior of building, as follows:
 - a. Roofs with no rooftop equipment requiring maintenance may be accessed using an internal ships ladder and roof hatch, size 3'0" x 2'-6", integral curb and flashing, insulated, c/w externally mounted safety grab handle, NRP hinges, and provision for padlock.
 - b. Roofs having rooftop equipment requiring limited maintenance may be accessed using an internal ships ladder (or service stair) and roof hatch, size 2' 6" x 4' 6" (2' 6" x 8' 0" for service stairs, integral curb, insulated, c/w externally mounted safety grab handle, NRP hinges, and provision for padlock.
 - c. Provide roof hatches with insulation value of RSI 3.5. Latch to be designed to permit one handed release. Use telescoping safety post extension mounted to ladder.
 - d. Hatches shall have a fixed railing system to provide a permanent means of fall protection for roof hatch openings. Rail system to have:
 - i. Standard self-closing and latching gate
 - ii. Non-penetrating attachment, attaching directly to roof hatch cap flashing
 - iii. Corrosion resistant construction.



- e. Roofs having rooftop equipment requiring occasional or regular maintenance or to a penthouse are to be accessed via normal stairway extending to the roof.
- f. Vertical ladders are only to be installed with authorization of FM&D. Where vertical ladders are used in areas accessible to the public, ladder shall be protected with a hinged door with padlock hasp mechanism. Padlock must be mounted such that it can be manipulated while standing on the floor.



- g. Separate levels of roofs to be connected preferably by external stairs, as a minimum by external ladders.
2. Where maintenance personnel would need to work close to parapets less than 1,100mm (3' 6") high, guard rails are to be provided. Alternatively, Fall Protection (refer to Section 7 – Safety & Security) is required.

5.3.6 Steep Roofs

1. Design steep roofs (slopes greater than 1 to 6) with a plane of waterproofing membrane/air barrier following the plane of ventilated cladding.
2. Configure steep roofs and perimeters so that snow, ice and rainwater will not create safety, maintenance or appearance problems. Design to prevent ice and snow from sliding into areas intended for use by vehicles or pedestrians.
3. Size eaves troughs to accommodate water from contributory roof and wall areas and to resist expected snow and ice loads. Off the shelf eaves troughs typically do not provide adequate resistance to dynamic loads from ice and snow and should not be used. Tie rainwater leader into storm drainage system, do not drain to grade.
4. Locate eaves troughs so they are accessible for regular maintenance and will not cause leakage into the building.
5. Observe the following minimum slopes for standard applications of shingles and shakes:
 - a. 1 to 6 for low slope strip shingles
 - b. 1 to 3 for triple tabbed strip shingles
 - c. 1 to 2.4 for cedar shingles
 - d. 1 to 2 for cedar shakes
6. Shallower slopes will require upgraded underlayment and increased head lap.

Revision History

Revision Date	Version	Description
Aug 2015	1.0	Baseline version
July 6, 2023	1.0	Added Revision History table to end of document and reset to Version 1.0.