



UNIVERSITY OF
TORONTO

Facilities & Services

Roofing design standard

Revision 02

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General design considerations

1. Torch applied or hot applied asphalt systems are not acceptable.
2. Prior to overlaying or retrofitting an existing roof assembly, the following items shall be completed¹:
 - 1) A full condition assessment of the existing assembly, reviewing deficiencies and degranulation of the existing membranes.
 - 2) Core samples of the existing assembly shall be taken to determine existing components and possible presence of moisture.
 - 3) A thermal scan of the existing assembly to determine the extent of moisture within the existing assembly. Depending on the amount of moisture present within the existing assembly, roof overlay and/or retrofit option may not be viable and replacement should be completed.
3. Prior to installing a vegetative roofing system, structural elements, or mechanical equipment, a structural analysis of the existing deck shall be provided and accepted by the owner.
 - a. Prior to placing any items directly on the roof, review the loading on the roof assembly.
4. Warranty requirements, considerations, and coverage:
 - 1) Two-year warranty covers the following (provided by roofing contractor):
 - a. Labour
 - b. Workmanship
 - 2) Twenty-five-year material manufacturer warranty covers the following:
 - a. Labour
 - b. Workmanship
 - c. Materials
 - 3) Should new equipment or penetrations need to be installed on or through the roof system in the first two years of the warranty period, only the contractor that originally completed the roof installation can perform the work using materials approved by the manufacturer holding the 25-year warranty.

¹ The lightweight insulating concrete system has an expected service life of 25 to 30 years. Upon achieving its expected service it can be overlaid with a new membrane, leaving the existing assembly in place.

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- 4) Once the two-year warranty period has expired, the manufacturer's warranty will govern who can complete work on the roof (work is relating to modifying the roof assembly, installing new mechanical equipment, vegetative roofing system, and any penetrations through the assembly). The manufacturer shall only contract certified roofing contractors to repair and execute roofing work, and must use materials approved by the manufacturer. For any projects being completed on any roof area, the design team shall review existing warranties with the owner to prevent voiding any warranty which may be in place.
 5. Waterproofing requirements for penetrations through existing roof assemblies:
 - 1) If the existing assembly is under warranty, follow manufacturers' written instructions and details for penetrations through the roof assembly.
 - 2) If the existing assembly is not under warranty, review the condition of the existing assembly. If the composition of the existing assembly is not previously documented, core samples of the existing assembly shall be taken to determine waterproofing details for new penetrations.
 - 3) If the existing assembly requires replacement, the installation of metal walkways, platforms, stairs, and steel structures can be coordinated with the replacement of the roof. Liquid or cold applied membrane flashings shall be carried up onto steel supports/structure a minimum of 304.8 mm (12") above the finished roof surface. Only compatible materials are to be used when tying into the existing assembly.
 - 4) Pitch boxes, pitch pans, or plastic boxes are not acceptable to seal penetrations through roof assemblies.
 - 5) Spun aluminum flashing accessories are to be used at roof penetrations such as gas lines, furnace stacks, soil stacks, and vents.
 - 6) For flexible conduits such as satellite cable or electrical cable, use spun aluminum goose neck with a rubber end cap.
 - a. Where multiple cables (telecommunication cables) need to be run across the roof membrane, a cable tray system is to be installed on patio pavers on polystyrene supports. Do not secure multiple cables through perimeter metal flashings along perimeters or walls which have been waterproofed.
 6. Solar panel system requirements for new construction projects or existing assembly replacement/retrofit:
 - 1) Review potential for solar panel system installation with design team and owner. Should it be acceptable to have a solar panel system installed, supports and structure (for solar panel system) should be incorporated into the new roof assembly.
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- 2) Solar panel contractor is responsible for protecting the newly installed roof system and to ensure the warranty remains intact.
- 3) Provide a sacrificial roofing membrane (loose-laid) on the roof assembly prior to placing solar panels and related equipment.
7. Fall protection, anchors, guard railings, and barriers:
 - 1) On new construction projects and roof replacement projects, review placement for fall protection, anchors, and barriers with design team and the owner.
 - a. For new construction projects, anchors are to be installed prior to the roofing installation.
 - b. For reroofing projects, anchors are to be installed during the roof replacement project.
 - 2) Fall protection, anchors, guard railings, and barriers are to be signed and stamped by a professional engineer licensed in Ontario.
8. Elevated walkways, platforms, and patio paver walkways:
 - 1) Waterproof all roof penetrations when the supports for elevated walkways and platforms penetrate the roof assembly.
 - 2) For walkway and platform supports that are ballasted, provide a sacrificial roofing membrane between the roof assembly and the support.
 - 3) Provide a minimum clearance of 760 mm (30 in) from the underside of the walkway/platform and the finished roof surface.
 - 4) Patio paver walkways are to be placed on extruded polystyrene pads. Provide a sacrificial roofing membrane between the finished roof assembly and the polystyrene pads. Patio pavers to be installed level.
9. Slate tile, standing seam metal, cedar shingles/shakes, and asphalt shingles roofs:
 - 1) Provide snow guard and/or electric heat tracing cables around the roof perimeter.
 - 2) Provide vents in field, soffit, and ridge vents required to meet ventilation requirements on existing roofs.
 - 3) Review the amount of venting to ensure the vents meet ventilation requirements on re-roofing project.

10. Metal flashings²
 - 1) Metal flashings shall have the minimum requirements:
 - a. 24-gauge thickness.
 - b. Pre-painted.
 - 2) Copper flashings shall be installed in the following locations:
 - a. Historical buildings, on both flat and sloped roofs.
11. Drains and drainage:
 - 1) Provide aluminum or copper drain strainers/screens. Plastic drain strainers/screens are not permitted.
 - 2) Provide positive drainage.
 - 3) Water on a roof shall dissipate within 48 to 72 hours at 20°C prior to it being considered ponding water:
 - a. For new projects, the structural deck can be made to slope to the drains at the initial design/installation stage; therefore, tapered insulation would not need to be incorporated into the roof system design.
 - b. For reroofing projects where the existing structural deck is not sloped to drain, tapered insulation would need to be incorporated into the roof system design.
12. Duct work and mechanical equipment:
 - 1) Mechanical equipment curbs for new construction projects shall be a minimum of 305 mm (12") above the finished roof surface.
 - 2) For reroofing projects mechanical equipment curbs should be a minimum of 203.2 mm (8"0 above the finished roof surface, 304.8 mm (12") is preferred with reroofing projects; however, this may not always be feasible.
 - 3) Ducts with width 1,200 mm (48") and greater:
 - a. Shall be installed with a minimum clearance of 760 mm (36") from the finished roof surface to the underside of duct.
 - b. For re-roofing projects, duct shall be raised and reinstalled at a minimum clearance of 760 mm (36") from the finished roof surface to the underside of duct.
 - 4) Ducts with widths less than 1,200 mm (48"):

² Metal flashings are not watertight and act as water shedding.

- a. Shall be installed with a minimum clearance of 450 mm (18") from the finished roof surface to the underside of duct.

13. Design wind load:

- 1) Install new roof systems to manufacturer's tested and approved roof system assemblies and meet or exceed design wind uplift resistance criteria of CSA A123.21.

07 51 00 Lightweight insulating concrete³

1. Roofing assemblies for new construction shall be lightweight insulating concrete with 2-ply modified bitumen membranes.
2. Should existing site conditions allow roofing assemblies for replacement and retrofit options will be lightweight insulating concrete with 2-ply modified bitumen membranes.
3. If the existing site conditions cannot support lightweight insulated concrete, the replacement and retrofit options are:
 - 1) 07 52 00 Conventional Modified Bitumen Membrane System
 - 2) 07 55 00 Protected Membrane System
4. The system is comprised of a structural deck (existing or new), deck board on a metal deck, vapour retarder, layers of expanded polystyrene (EPS) insulation set in lightweight concrete (LWIC), a 25.4 mm to 38.1 mm (1" to 1 1/2") top pour of LWIC and a waterproofing membrane shall be designed to have an average R-value of R-30. Material thickness and weights typically consist of the following:
 - 1) Deck board (for metal deck applications), minimum 12.7 mm (0.5") gypsum roofing board adhered or mechanically fastened in place, weight is approximately 9.765 kg/m² (2 lbs/ft²).
Note: concrete structural decks do not require a deck board.
 - 2) Self-adhering modified bitumen vapour retarder, fully adhered in place over existing concrete deck or deck board.
 - 3) Expanded polystyrene insulation can be installed in varying thicknesses, ranging from 0 to 304.8mm (0 to 12") in thickness and weighting from 14.159 kg/m² to 25.389 kg/m² (2.9 lbs/ft²

³ Provide positive slope to drain (the LWIC topping can be formed or built up with layers of EPS to provide as much slope as desired, even on level roof structures).

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- to 5.2 lbs/ft²) (dry weight) and 27.830 kg/m² to 45.407 kg/m² (5.7 lbs/ft² to 9.3 lbs/ft²) (wet weight). The R-value for these thicknesses' ranges from R-0.9 to R-45.1.
- 4) Vented base sheet is mechanically secured in place to the lightweight insulating concrete.
 - 5) Modified bitumen base sheet is fully adhered in place over the vented base sheet with cold adhesive. The base sheet typically consists of a glass mat reinforcement impregnated and coated with SBS (Styrene-Butadiene-Styrene) modified bitumen. They have an average thickness of 91 mils (2.3 mm) and conform to the following standards, ASTM D6163 Type I, Grade S and CSA A123.23-15 Type A, Grade 2.
 - 6) Granulated modified bitumen cap sheet is fully adhered in place over the modified bitumen base sheet with cold adhesive. The cap sheet typically consists of a glass mat reinforcement impregnated and coated with SBS modified bitumen, top surface is coated with granules. They have an average thickness of 130 mils (3.3mm) and conform to the following standards, ASTM D6163 Type I, Grade G and CSA A123.23-15 Type A, Grade 1.
 - 7) Total weight of the modified bitumen sheets is approximately 9.765 kg/m² to 12.206 kg/m² (2 to 2.5 lbs/ft²).
5. The lightweight insulating concrete will have a compressive strength of 2068 kpa (300 psi).
 6. Vegetative roof and reflective roof system:
 - 1) Reflective roof system will use a cool (white) modified bitumen cap sheet membrane (instead of the standard cap sheet listed above). The modified bitumen membrane cap sheet shall have a Solar Reflectance Index (SRI) value of 80 or greater.
 - 2) Vegetative roof system will incorporate a leak detection system, root barrier, drainage layer, growing medium tray system, and irrigation system.
 - a. Leak-detection system involves a conductive material being installed below the membrane.
 - b. Leak-detection system shall continuously monitor for any occurrences of leakage and promptly send notifications to the designated personnel.

07 52 00 Conventional modified bitumen membrane system

1. Conventional modified bitumen membrane systems with polyisocyanurate insulation shall be an option for roof replacement and retrofit applications only.

2. The system is comprised of a structural deck (existing), deck board on a metal deck, vapour retarder, layers of polyisocyanurate insulation (flat and tapered options are available) set in ribbons of polyurethane adhesive, cover board set in ribbons of polyurethane adhesive and waterproofing membranes. Material thickness and weights typically consist of the following:
 - 1) Deck board (for metal deck applications), minimum 12.7 mm (0.5") gypsum roofing board adhered or mechanically fastened in place, weight is approximately 9.765 kg/m² (2 lbs./ft²).
 - 2) Self-adhering modified bitumen vapour retarder, fully adhered in place over existing concrete deck or deck board.
 - 3) Polyisocyanurate insulation adhered in place with ribbons of polyurethane foam adhesive. Polyisocyanurate insulation is available in both flat and sloped configurations. Typically, polyiso is available in 1.2192 m x 1.2192 m (4'x4') and 1.2192 m x 2.4384 m (4'x8') board sizes and various thicknesses. The R-value per inch is approximately R-5.7.
 - 4) Cover boards are available in various materials and can all be adhered in place with ribbons of polyurethane foam adhesive. Some options for cover boards are,
 - a. Minimum 12.7 mm (0.5") gypsum roofing board
 - b. Minimum 6.35 mm (0.25") asphaltic board
 - c. Minimum 12.7 mm (0.5") HD polyisocyanurate board
 - 5) Modified bitumen base sheets typically consist of glass mat reinforcement impregnated and coated with SBS modified bitumen. They have an average thickness of 2.3 mm (91 mils) and conform to the following standards, ASTM D6163 Type I, Grade S and CSA A123.23-15 Type A, Grade 2.
 - 6) Granulated modified bitumen cap sheets typically consist of a glass mat reinforcement impregnated and coated with SBS modified bitumen, top surface is coated with granules. They have an average thickness of 3.3 mm (130 mils) and conform to the following standards, ASTM D6163 Type I, Grade G and CSA A123.23-15 Type A, Grade 1.
 - 7) The membrane system shall follow a 2-ply configuration with the first layer (referred to as a "base sheet") being fully adhered to the substrate with adhesive. A second membrane layer (referred to as a "cap sheet") is then adhered to the base sheet either with cold process products or adhesives.

07 55 00 Protected membrane systems

1. Protected membrane systems shall be an option for re-roofing or retrofit options only.
2. The system is comprised of a structural deck (existing), deck board on a metal deck, waterproofing membranes, drainage layer, extruded polystyrene insulation, filter fabric, and stone ballast and/or patio pavers. Material thickness and weights typically consist of the following:
 - 1) Deck board (for metal deck applications), minimum 12.7 mm (0.5") gypsum roofing board adhered or mechanically fastened in place, weight is approximately 9.765 kg/m² (2 lbs./ft²).
 - 2) Modified bitumen base sheets typically consist of a glass mat reinforcement impregnated and coated with SBS modified bitumen. They have an average thickness of 2.3 mm (91 mils) and conform to the following standards, ASTM D6163 Type I, Grade S and CSA A123.23-15 Type A, Grade 2.
 - 3) Granulated modified bitumen cap sheets typically consist of a glass mat reinforcement impregnated and coated with SBS modified bitumen, top surface is coated with granules. They have an average thickness of 3.3 mm (130 mils) and conform to the following standards, ASTM D6163 Type I, Grade G and CSA A123.23-15 Type A, Grade 1.
 - 4) The drainage layer consists of a polypropylene dimpled core and a factory laminated filter fabric. This drainage layer is loose laid over the complete membrane, prior to installation of extruded polystyrene insulation.
 - 5) Extruded polystyrene insulation is loose laid in place over the drainage layer, butted tight. It is available in various sizes and thicknesses. The R-value per inch is approximately R-5.
 - 6) Filter fabric is loose laid in place over the extruded polystyrene insulation. Filter fabric is a non-woven geotextile made of polypropylene fibers.
 - 7) Ballast shall consist of round river rock and/or patio pavers. Ballast shall be placed over top of the assembly at an approximate weight of 58.589 kg/m² (12 lbs./ft²).