SECTION  – hot-applied rubberized asphalt protected membrane roofing

1. General
   1. summary
      1. Two Ply Reinforced Liquid Membrane Roofing: Fully adhered inverted roofing system with primer and 2 ply sites installed hot, fluid applied, rubberized asphalt membrane with protection layer, primary insulation; on Drawing A220, and as follows:
         1. F3 - Parking Garage - Heated Suspended Garage Ramp and Slab.
         2. R1 - Vegetated Protected Membrane Roofing System: Membrane and rigid insulation system on concrete slab, with filter cloth, root barrier and vegetated pre-grown tray system.
         3. R2 - Terrace Roof Insulated Assembly: Membrane and rigid insulation system on concrete slab, with precast concrete pavers on crushed stone and washed sand leveling bed.
         4. R3 - Ballast Roof Insulated Assembly: Membrane and rigid insulation system on concrete slab, with stone ballast.
         5. R4 - Ballast Roof Insulated Canopy Assembly: Membrane and rigid insulation system on concrete slab, with stone ballast.
         6. R5 - Roof Terrace Assembly: Membrane on concrete slab, with precast concrete pavers on crushed stone and washed sand leveling bed.
         7. R6 - Vegetated Roof Assembly: Membrane on concrete slab, with filter cloth, root barrier and vegetated roof system.
         8. R7 - Vegetated Roof Assembly: Membrane on concrete slab, with filter cloth, root barrier and vegetated roof system.
         9. R8 - Parking Garage Roof - Concrete Wearing Slab Assembly: Membrane on concrete slab, with protection board, granular base, and heavy-duty reinforced cast-in-place concrete slab.
         10. R9 - Parking Garage Roof - Concrete Wearing Slab Assembly: Membrane on concrete slab, with protection board, granular base, and heavy-duty reinforced cast-in-place concrete slab.
      2. Related Requirements:
         1. Section 07 62 00 – Sheet Metal Flashing and Trim.
         2. Section 07 72 33 – Roof Hatches and Accessories.
         3. Section 07 92 00 – Joint Sealants.
   2. reference standards
      1. American Society for Testing and Materials (ASTM):
         1. ASTM D 41/D 41M-11, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
         2. ASTM D 1863/D 1863M-05(2011) e1 Standard Specification for Mineral Aggregate Used on Built Up Roofs.
         3. ASTM D 6622 01(2009) Standard Guide for Application of Fully Adhered Hot Applied Reinforced Waterproofing Systems.
      2. Canadian General Standards Board (CGSB):
         1. CAN/CGSB 37.50 M89, Hot Applied, Rubberized Asphalt for Roofing and Waterproofing (withdrawn).
         2. CAN/CGSB 37.51 M90, Application of Hot Applied Rubberized Asphalt, for Roofing and Waterproofing (withdrawn).
      3. Underwriters Laboratories Canada (ULC):
         1. CAN/ULC S701 05, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
         2. CAN/ULC S770 03, Determination of Long-Term Thermal Resistance of Closed Cell Thermal Insulating Foams.
   3. submittals
      1. Provide required information in accordance with Section 01 33 00 – Submittals Procedures.
      2. Action Submittals: Provide the following submittals before starting any Work of this Section:
         1. Product Data:
            1. Submit copies of the most current technical data sheets describing physical properties of materials, and explanations about product installation, including installation techniques, restrictions, limitations, and other manufacturer recommendations.
            2. Submit membrane manufacturer's standard details that will be utilized for this Project, indicate changes that must be made to make the details project specific for review by the Consultant.
         2. Garden Roofing Submittals:
            1. Submit two (2) samples of vegetated modules, showing same or similar product grown to maturity, with homogeneous mix of cutting grown plants, with 95% or greater coverage, as it will be delivered to job site.
            2. Provide two (2) plastic bags, each containing a .25 kg sample of growing medium.
            3. Provide additional agreements of warranty and maintenance contract.
            4. Provide written maintenance protocol.
            5. To ensure proper plant selection and efficient delivery, provide address and contact information of professional horticulturist who will oversee planting and cultivation of modules, within 480 km of project location.
            6. To ensure efficient and correct use of materials, submit shop drawings indicating layout of modules, and square footage.
      3. Informational Submittals: Provide the following submittals when requested by the Consultant:
         1. Certificates:
            1. Submit certification from an independent testing laboratory experienced in testing rubberized asphalt material stating that material supplied for the Project meets or exceeds the requirements of CGSB 37.50, including ASTM procedures listed with in the standard.
            2. Submit certification indicating full time quality control of production facilities responsible for manufacture of rubberized asphalt and batch records for tested material indicating conformance to manufacturer's published physical properties.
   4. QUALITY ASSURANCE
      1. Applicator must maintain a full-time experienced journeyman roofer, and at least one (1) apprentice per crew on the Work at all times:
         1. Only skilled and certified trade persons, officially employed by a roofing contractor operating adequate and necessary equipment, and who are thoroughly trained and experienced and completely familiar with manufacturer's recommended methods of installation.
         2. Crew members using torches must be trained under a recognized training program and certified from the manufacturer of materials being installed.
      2. Quality Assurance:
         1. Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification. Advise designer of any discrepancies prior to commencement of the Work.
         2. At the beginning of the Work and at all times during the execution of the Work, allow access to site by the waterproofing membrane manufacturer's representative.
         3. Maintain one copy of manufacturer's literature on site throughout the execution of the Work.
      3. Garden Roofing System:
         1. Manufacturer: Company specializing in manufacturing the products specified in this Section, with minimum five (5) years experience.
         2. Applicator: Company specializing in tray garden roofing system installation, with minimum five (5) years documented experience and approved by materials manufacturer for guaranteed work. Provide certificate of completion of training issued by green roof system manufacturer.
      4. Interface with Adjacent Systems:
         1. Coordination between all installers of each component of vapour and air retarder system is essential to ensure continuity of system and that junctions between the various components are effectively sealed.
         2. Verify with manufacturers and all tradesmen involved with installation procedures of building products incorporated into air barrier elements including, but not limited to, various membranes, coatings, and sealants as well as continuity with roofing membrane.
      5. Compatibility:
         1. Materials used in this Section, including, primers, mastics and membranes, asphaltic protection boards, composite drainage boards and expansion joint membranes shall be fully compatible and shall be sourced and or produced by one manufacturer.
         2. Provide a written declaration to the Consultant that roofing materials and components are compatible with wall air and vapour retarder membranes.
         3. Work shall be so scheduled as to provide a watertight seal at the end of each working day on the areas worked upon during the day.
      6. Roofing Inspection:
         1. Owner reserves the right to engage an inspection firm to perform roof inspections and testing in accordance with Division 01; do not include any cost for inspection in the Work of this Section.
         2. Cooperate with roofing envelope inspector; repair or replace membrane air and vapour retarder system as directed by inspector.
   5. STORAGE, DELIVERY, HANDLING AND PROTECTION
      1. Deliver materials to the job site; handle and store in original packages and containers with manufacturer's seals and labels intact; manufacturer's name, brand, mass, specification number and lot number must be shown on the labels.
      2. Store materials in weatherproof shelters having floors that will protect the materials from moisture; store materials on end; avoid prolonged exposure of light or heat sensitive materials to sunlight.
      3. Do not store materials on roof in concentrations that exceed design live load.
      4. Place plywood runways over the Work to enable the movement of materials and other traffic during construction of roofing.
      5. Protect surrounding surfaces against damage from roofing work. Where hoisting is necessary, hang tarpaulins to protect walls during delivery of materials from ground to roof.
      6. In the event of materials damage by the elements, improper handling or other causes, such materials will be rejected and will be replaced at no extra cost to the Owner. Remove rejected materials promptly from the site.
      7. During roofing work, exposed surfaces of finished walls must be protected with tarp to prevent damage. Contractor shall assume full responsibility for damage.
      8. Garden Roofing Materials:
         1. Green roof modules are to be delivered in good condition free from shipping damage.
         2. Keep garden roofing modules out of sun if plastic wrapped, to prevent overheating.
         3. Install garden roofing modules within four (4) hours of delivery.
         4. During installation, protect the roof deck and membranes with appropriate material such as plywood sheeting. Don't scrape or puncture the slip sheet or membranes. Keep roof surfaces free of soil, grit, or debris at all times with broom. Never set modules on top of soil, dirt, or grit.
   6. PRE-INSTALLATION MEETING
      1. Hold a pre-installation meeting prior to start Work of this Section; include the roofing manufacturer's representative, roofing contractor's representative, the roofing inspector, the Contractor, the Consultant and Owner.
      2. The purpose of this meeting is to review installation conditions particular to this project and review materials specified in this Section as follows:
         1. Convene 1 week before commencing work of this Section in accordance with requirements specified in Section 01 31 19 – Project Meetings.
         2. Agenda shall include, but not be limited to, coordination and installation requirements of specified roofing membranes, requirements for maintaining warranty conditions for membranes during installation of concrete toping materials, and review materials, assemblies, and procedures for roofing and waterproofing.
         3. The roofing inspector will complete the minutes and prepare a report for this meeting.
   7. site conditions
      1. Confirm that concrete surfaces are sufficiently cured in accordance with manufacturer's written requirements prior to application of membranes.
      2. Minimum ambient application temperature shall not be less than -23 deg C.
      3. Notify Consultant and roofing inspector where installation is required below stated minimum temperature and submit manufacturer's standard cold weather installation practices prior to proceeding with Work of this Section.
      4. Environmental Requirements: No installation work shall be performed during rainy or inclement weather and on frost or wet covered surfaces.
      5. Protection: Temporary protection of the membrane shall be provided to prevent mechanical damage or damage from spillage of oil or solvents until such time as permanent protection is provided.
   8. WARRANTies
      1. The product manufacturer shall issue a written and signed warranty in the owner's name, certifying product performance properties for a period of ten (10) years, starting from the date of substantial completion. The document will wholly and completely cover the specified warranty period starting from Substantial Performance of the entire Contract.
      2. Coordinate requirements of manufacturer's warranty with associated drainage materials and installation
      3. Warranty items shall include:
         1. Materials: excluding site labour.
         2. Installation and Water Tightness: including labour and materials.
         3. System Integrity: including labour and materials for components of the roofing and waterproofing system including, but not limited to, the following:
            1. Membrane.
            2. Protection board.
            3. Flashings.
            4. Insulation.
         4. Garden Roofing Manufacturer's Warranty: Manufacturer's standard form covering repair or replacement of garden roofing trays that fails in materials or workmanship within a period of two (2) years from date of Substantial Performance for the project.
2. Products
   1. MANUFACTURERS
      1. Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the Work include, but are not limited to, the following:
         1. Henry Company.
         2. Hydrotech Membrane Corporation.
         3. Tremco Incorporated.
      2. Acceptable Garden Roofing Manufacturers:
         1. LiveRoof.
         2. Bioroof.
   2. materials
      1. Primer: Quick setting, solvent-based, synthetic rubber sealant adhesive.
         1. Basis-of-Design Material: Henry 930-18 Polymer Modified Adhesive by Henry Company.
      2. 2 Ply Reinforced Membrane:
         1. Membrane: Hot applied, liquid rubberized asphalt formulated to provide a monolithic fully bonded roofing membrane, meeting the requirements of CGSB 37.50; specifically formulated for roofing and waterproofing membrane systems.
            1. Basis-of-Design Material: 790-11 by Henry Company.
         2. Membrane Reinforcement: Roofing membrane manufacturer's standard duty spun bonded polyester fabric reinforcing sheet.
      3. Heat Resistant Base Membrane Flashing:
         1. Membrane: Self adhered lower surface composite membrane consisting of modified bituminous membrane with release film.
         2. Basis-of-Design Material: ModifiedPLUS G100 Tack Sheet Sand by Henry Company.
      4. Cap Membrane Flashing:
         1. Modified Bituminous Membrane: Manufacturer's system specific, nominal 4 mm thickness, mop grade reinforced flashing membrane.
         2. Basis-of-Design Material: ModifiedPLUS NP180gM Poly Cap by Henry Company.
      5. Adhesives and Sealants:
         1. Manufacturer's system specific contact adhesives, splicing cement, bonding adhesive and termination sealants.
      6. Securement Bars:
         1. Continuous aluminum, stainless steel or galvanized metal, 3 mm x 25 mm (1/8" x 1") in size and shall be pre-drilled for non-corrosive screw attachment on a maximum of 305mm (12") centers.
      7. Asphalt Protection Board shall be 3 mm (1/8") thick asphalt core protection board having the following physical properties:
         1. Core: Mineral filled high melting point asphalt.
         2. Top surface: Inert non-woven glass reinforcing mat with polyethylene film cover.
         3. Bottom surface: Inert non-woven glass reinforcing mat.
      8. Prefabricated Drainage Board (Vertical and Horizontal):
         1. 10mm (3/8") polypropylene core drainage board with polypropylene fabric and a minimum compressive strength of 11,000 psf.
         2. Basis-of-Design Material: DB6200 by Henry Company.
      9. Inverted Roof Insulation:
         1. Extruded expanded polystyrene (EXPS) roof insulation consisting of largest panels practical, conforming to ULC S701, Type 4, thickness as indicated, having a minimum compressive strength of 276 kPa; and having a nominal ULC S770 LTTR RSI 0.88:
         2. Acceptable Materials:
            1. Dow Construction Materials, HI 40.
            2. Owens Corning, Foamular 400.
      10. Roof Overburden:
          1. Concrete Pavers: High density hydraulic pressed pavers, nominal 24" x 24" (610mm x 610mm) weight not exceeding 45 kg per unit, colours selected by Consultant from standard range, and as indicated on Drawings.
          2. Stone Ballast: Well screened and washed stone gravel meeting the requirements of ASTM D 1863/D 1863M-05(2011) e1.
          3. Concrete Topping: As indicated on Structural Drawings.
      11. Prefinished Metal Flashing and Trim: As indicated in Section 07 62 00 – Sheet Metal Flashing and Trim.
   3. GARDEN ROOFING SYSTEM MATERIALS
      1. Module Roofing System Characteristics:
         1. Size: 12" x 24" (305mm x 610mm) tray; soil height raised to approximately 100mm (4") elevation.
         2. Material: 1/8" thick, 100% post-industrial recycled polypropylene.
         3. Colour: Black.
         4. Modules contain positive drain holes placed at lowest point in the module.
         5. Basis of Design Materials:
            1. LiveRoof Lite System by LiveRoof.
      2. Soil Characteristics:
         1. Soil height: Approximately 100mm (4").
         2. Monolithic soil continuum, approximately 19mm (1-1/4") taller than modules and shall obscure modules during all twelve (12) months of the year for optimal year-round aesthetic presentation.
         3. Join soil via subterranean moisture portals uniting soil from module to module.
      3. Plants:
         1. Plant material to cover minimum of 95% of surface area of soil within modules at time of delivery.
         2. Homogeneous mix of cutting highly grown drought resistant ground covers. Include accent plants for enhanced height, texture, or early/late season bloom times.
         3. Module planting and cultivation to occur under supervision of professional horticulturist located within 480 km of project location.
      4. Accessories:
         1. Edging: L-shaped extruded aluminum edging with perforations for drainage. Edging is 89mm x 76mm (4 1/2" x 3") with a minimum gauge of 3mm (1/8"). Edging, regardless of type, must allow for adequate drainage via sufficient drain perforations at the bottom of the edging, with sidewalls tall enough to cover the modules and contain the soil.
3. Execution
   1. surface EXAMINATION and preparation
      1. Surface examination and preparation must be completed in conformance with manufacturers written instructions.
      2. Inspect deck conditions including, but not limited to, up stands and parapets; roof slopes, construction joints, roof drains, plumbing vents, ventilation outlets and other penetrations.
      3. Notify consultant of conditions that do not conform to manufacturer's requirements so that required corrections can be made.
      4. Starting roofing work will mean acceptance of roofing conditions.
      5. Do not begin work before surfaces are smooth, dry, and free of ice and debris; use of calcium or salt is forbidden for ice or snow removal.
      6. Do not start Work of this Section until plumbing, carpentry and other related work has been completed.
      7. Do not install materials during rain or snowfall.
      8. Provide fire protection during installation.
   2. preparation
      1. Verify that concrete is monolithic, smooth, free of voids, spalled areas, laitance, honeycombs, and sharp protrusions that could affect roof membrane installation.
      2. Thoroughly sweep and air clean substrate to meet manufacturer's written requirements to remove any remaining loose debris.
      3. Verify membrane adhesion after slab is cleaned; correct deficient substrate conditions where adhesion test fails.
   3. membrane INSTALLATION
      1. Primer Application: Apply primer to concrete surfaces in accordance with manufacturer's written instructions; allow sufficient time for primer to sufficiently dry prior to membrane application.
      2. Membrane Flashing: Install membrane flashings in accordance with manufacturer's standard details, modified to meet project specific requirements; complete detail flashing before installing field membrane materials.
      3. Membrane Application:
         1. Install membrane in accordance with manufacturer's written instructions in 2 monolithic layers with polyester reinforcing membrane between subsequent coats:
            1. 2mm nominal thickness for first layer.
            2. 3mm nominal thickness for second layer.
            3. 5mm total nominal thickness.
         2. Embed membrane protection layer into hot asphalt and seal overlapping edges with roofing torch.
   4. water test
      1. Coordinate with testing agency, protect interior building components against damage arising from leakage testing.
      2. Conduct testing to verify membrane is free of any holes, open seams and capillary defects that will allow water to pass.
      3. Repair any membrane weaknesses and leaks identified by water testing method; retest membrane after repairs is complete and provide certification of completed test results to the Consultant.
   5. INSULATION INSTALLATION (INVERTED ASSEMBLY)
      1. Loose lay insulation on separation sheet. Butt boards together snugly. Install 100mm (4") thickness in two layers with joints in upper and lower layer staggered and offset.
      2. Cut insulation to fit insulated surfaces, laying it with joints tightly fitted between adjacent sheets in "stack bond" pattern.
      3. Completely cover insulation with filter cloth, lap edges and ends a minimum of 250mm (10"); do not adhere to insulation, tuck under metal flashings. Use no pieces smaller than 914mm (3') width or 1830mm (6') length.
   6. HARD SURFACE AND ACCESSORY INSTALLATION
      1. Install pavers or stone ballast as indicated on Drawings.
      2. Install gravel ballast to field areas of designated roofs in accordance with manufacturers written instructions, at minimum rate of 110 kg/m2; spread gravel onto filter cloth.
      3. Install concrete paving surfaces in accordance with Structural Drawings.
      4. Install precast concrete dividers on wash sand and crushed stone, located on terraces, as indicated on the drawings. Saw cut all pavers, do not chip or break. No paver less than 1/2 unit.
   7. INSTALLATION - GARDEN ROOFING SYSTEM
      1. Module installation to be conducted:
         1. When plants are properly adapted and acclimatized to local weather conditions.
         2. When weather is above 2 deg C and there is no ice on the roof and engineered soil is unfrozen.
         3. No later than the cut off date required by the green roof system providers warranty terms, if applicable.
      2. Module Installation:
         1. Module installation to follow behind installation of slip sheet/root barrier, and edging.
         2. Module installation to be conducted in strict accordance with manufacturer installation guidelines. Surface to be clean and swept free of soil, dirt, stones, or grit before placing each module. Rows to be straight, modules to be tight against each other with edges overlapping and arranged in proper directional orientation.
         3. Module installation to be conducted in accordance with green roof design.
         4. Modules to be placed directly on top of appropriate slip sheet/root barrier.
         5. It is recommended that the cut side of the module be set tight against the edging or toward the side of an intact module so as to prevent soil spillage.
         6. Immediately water modules thoroughly after installation so as to moisten the media from top to bottom.
         7. First maintenance visit to be conducted two (2) weeks after installation is completed.
   8. SHEET METAL FLASHING AND TRIM
      1. Complete flashing work using specified materials described on plans and details, and as described in Section 07 62 00 – Sheet Metal Flashing and Trim.
      2. Nails, staples, screws, bolts, washers, and other metal fasteners will be made of compatible and rust proof metals, of same colour as surfaces with which they are in contact.
   9. CLEANING
      1. The work site must be routinely cleared of rubbish and other materials that may hinder roof installation, performance or present a fire hazard.
      2. At completion of Work, remove waste materials and items that could cause a roof puncture.
      3. Clean adjacent surfaces of asphalt, bitumen, and other roofing materials deleterious to appearance or function.
      4. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION