

**SPEC NOTE:** This guide specification is intended for use when specifying a (TPA) multi-ply liquid/sheet combination roofing system, using a hot-adhesive method or cold-adhesive method of application. Make any required selections, such as board size, thickness, etc. Where selection is indicated with an [OR] statement, select the appropriate paragraph and delete the inappropriate statement. Delete all SPEC NOTES and [OR] statements prior to final printing.

**DISCLAIMER:** The manufacturer has reviewed the product information contained in this guide specification. The information is organized and presented to assist the specification writer working on a construction project to select the appropriate products and to save time in writing the project specification Section. The specification writer is responsible for product selection as well as the use and application of this information, and should contact the manufacturer to ensure that all options are available and that the associated specification information is valid and correct.

**SPEC NOTE:** Coordinate this article with requirements included under Division 1, Section 01600 - Material and Equipment (Product options and substitutions) as well as instruction to Bidders.

#### **1.0 GENERAL**

**SPEC NOTE:** This clause is optional, and if using, ensure description of work is brief and concise. E.g. General Conditions, Supplementary Conditions and Division 01 apply to this Section; and/or;

#### **1.1 WORK INCLUDES**

- .1 Substrate Preparation
- .2 Monolithic Waterproofing Cold Adhesive
- .3 Elastomeric Waterproofing & Reinforcement
- .4 Elastomeric Flashing Sheet
- .5 Drainage / Moisture Retention Panel
- .6 Growing Medium
- .7 Vegetation

**SPEC NOTE:** Reference appropriate Sections and ensure List is complete

#### **1.3 RELATED WORK**

- .1 Section 033xx - Concrete work.
- .2 Section 053xx - Steel Deck
- .3 Section 061xx - Rough Carpentry (Cants, Wood Blocking, etc.)
- .4 Section 075xx - Air Barriers (tie-ins to vertical wall)
- .5 Section 076xx - Sheet Metal Flashing and Trim (counter flashings)
- .6 Section 077xx - Roof Hatches
- .7 Section 078xx - Roof Accessories (skylights)
- .8 Section 110xx - Roof Anchors
- .9 Section 154xx - Plumbing (Supply of Roof Drains)

**SPEC NOTE:** This clause is optional. Reference appropriate Sections and ensure List is complete e.g.

#### **1.4 PERFORMANCE REQUIREMENTS**

- .1 General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure during the Installers specified warranty.

- .2 Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- .3 Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations of the membrane manufacturer.

#### 1.5 SUBMITTALS

- .1 Provide written verification from Wytech Building Envelope Solutions Inc (416)439-5442 [roofing membrane manufacturer] that all green roofing components are acceptable, meeting pre-established performance requirements.
- .2 Shop Drawings: For roofing system. Include plans elevations, sections, details in compliance with performance requirements, and attachments to other Work.
- .3 Manufacturer Certificates: Signed by roofing system manufacturer certifying that roofing, growing medium, and plant installers are approved, authorized, or licensed by manufacturer to install vegetated roofing system.
- .4 Installer Certificates: Signed by roofing contractor certifying that roofing system complies with requirements specified in Performance Requirements for two years.
- .5 Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system when required by the Owners representative.
- .6 Submit product data sheets for [cold process roofing] [ ] [insulation]. Include:
  - .1 Provide product data on membrane materials, base flashings and insulation.
  - .2 Provide data on the lightweight growing medium, indicating mix of organic and inorganic materials, and data on bulk density at saturation.
  - .3 Provide certification of seed mixtures/plants.

#### 1.6 PRE-INSTALLATION CONFERENCE

- .1 Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Comply with requirements for pre-installation conferences in Division 1 Section "Project Management and Coordination." Review and document methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:

**SPEC NOTE:** If retaining, revise to include Project-specific requirements. Insert additional requirements to suit Project.

- .1 Meet with Owner, Architect, Owner's insurer if applicable, roofing Contractor, roofing system Manufacturer's

representative, vegetative Installers and installers whose work interfaces with or affects green roofing including installers of roof accessories and roof-mounted equipment.

- .2 Review methods and procedures related to green roofing installation, including manufacturer's written instructions.
- .3 Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- .4 Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
- .5 Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
- .6 Review governing regulations and requirements for insurance and certificates if applicable.
- .7 Review temporary protection requirements for roofing system during and after installation.
- .8 Review roof observation and repair procedures after roofing installation.
- .9 Provide certification showing that all components of the green roof assembly are supplied and warranted by the roofing membrane manufacturer.

#### **1.7 QUALITY ASSURANCE**

- .1 Green Roof Assembly: Companies specializing in manufacturing and developing products of this section with five years documented experience.
- .2 Membrane applicator: Minimum five years documented experience and approved by membrane manufacturer.
- .3 Landscape Subcontractor qualifications: Execute the work of this section only by a subcontractor who has adequate equipment and skilled workers with the following qualifications:
  - .1 A thorough understanding of proper horticulture techniques.
  - .2 Good taxonomy skills and able to competently identify undesired species at various growth stages.
- .4 Submit documented experience to Consultant.
- .5 Cooperate with the inspector and afford all facilities necessary to permit full inspection of the work and testing of materials prior to their use.
- .6 Pre-installation meeting: Prior to commencing Work of this Section, arrange for manufacturer's technical representative to review procedures to be adopted, conditions under which the Work will be done, and inspect the surfaces to receive the roofing

membrane Products, in order that any alternate recommendations may be made should adverse conditions exist.

- .7 Verification of performance: Arrange for manufacturer's technical representative to inspect the Work at intervals during application, and on completion submit written verification of compliance with specifications and drawings.
- .8 Inspection and testing:
  - .1 Inspection and testing will be performed by an independent inspection and testing company appointed and paid by the Owner.
  - .2 If so required by the inspection and testing company or by the Consultant, make any cut tests required. After cut tests are completed, repair waterproof membrane.

**SPEC NOTE:** Electronic testing is an option. If retaining, revise to include Project-specific requirements. Insert additional requirements to suit Project (see also Execution 3.9)

- .3 Electronic Testing: Perform leak testing by an electronic detection process administered by a qualified testing agency.

#### **1.8 PRODUCT DELIVERY, STORAGE and HANDLING**

- .1 Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- .2 Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
- .3 Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- .4 Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

#### **1.9 VERIFICATION OF STRUCTURAL CAPACITY**

- .1 Obtain prior, written confirmation from a professional engineer certifying that the structure is capable of bearing the additional load of the entire green roof system.

#### **1.10 ENVIRONMENTAL REQUIREMENTS**

- .1 Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

Stop work when temperature or when wind chill effect would tend to set adhesives before application and adhesion of membranes could take place.

- .2 Ensure substrate is dry and frost free.
- .3 Use only dry materials and apply only during weather that will not introduce moisture into the roof system.

#### **1.11 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section [01355- Waste Management and Disposal], and with Waste Reduction Workplan.

**SPEC NOTE ENVIRONMENT:** Since emptied containers retain product residues (vapours, liquids and/or solids) extreme caution should still be exercised in their handling. Keep out of the reach of children.

- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Plan and coordinate insulation work to minimize generation waste. Collect over spray and sweep-ups for return to manufacturer and recycling.
- .7 Collect and separate plastic and/or paper packaging for recycling.
- .8 Use the least toxic sealants, and adhesives necessary to comply with requirements of this section.
- .9 Close and seal, tightly, all partly used sealant and adhesive containers and store protected in well ventilated, fire-safe area at moderate temperature.
- .10 Place used hazardous sealant tubes and adhesive containers in areas designated for hazardous materials.
- .11 Collect, package and store part, unused containers of asphalt, sealing compounds and primers and their contents for recycling and return to recycler in accordance with Waste Management Plan.

#### **1.12 MAINTENANCE PROGRAM**

- .1 Provide maintenance program for the warranty period as per the following.
- .2 First year maintenance schedule:
  - .1 Weekly inspection of the entire green space for the first eight weeks: provide irrigation if needed to ensure a

- complete green cover of the whole surface of the green roof by the specified plant mix.
- .2 Bi-weekly inspection for further eight weeks, including irrigation if needed and operation of re-planting if necessary in certain areas, weeding of undesired aggressive tall species and woody seeding.
  - .3 One early Fall visit for weeding of undesired aggressive tall species and woody seeding, inspection and cleaning of the roof drains.
- .3 Second year maintenance schedule:
- .1 Six visits during the second year.
  - .2 Early Spring visit to remove litter, weed out germinating seeds from the Fall, re-planting where necessary, apply an organic granular fertilizer over the entire surface and inspect and clean the roof drains.
  - .3 Four monthly inspection for operations of weeding undesired tall species, especially the woody seedlings and ensure a complete green cover of the whole surface of the green roof by the specified plant mix.
  - .4 One late Fall visit for weeding out germinating woody seedlings, inspection and cleaning of the roof drains.
- .4 Maintenance Reports
- .1 The subcontractor will, during the first year, submit a maintenance report at the end of each month.
  - .2 The report will include: inspection dates, maintenance personnel at each visit, activities performed, notes on growing condition, note on adjustments made during visit.
  - .3 Report to be signed by the maintenance subcontractor, maintenance personnel and verified by a representative of the building Owner.
  - .4 Copies to be submitted to the Building Owner and membrane manufacturer.
  - .5 A subcontractor not conforming to this schedule will be replaced but will be deemed to be responsible and will bear all costs of the new subcontractor

**1.13 WARRANTY**

- .1 Submit extended warranties in accordance with the General Conditions of the Contract.
- .2 Installer's Extended Warranty: standard [CRCA] [OIRCA] 2 year warranty, commencing from the date of Substantial Performance of the Work.
- .3 Manufacturer's Extended Warranty: a written guarantee that the manufacturer will replace, at no cost to the Owner, any portion of the roofing membrane which experiences actual leaks resulting from

defects in the manufacture of the membrane for a period of [10][15] years, commencing from the date of Substantial Performance of the Work.

AND/OR

- .3 Green Roof Performance Warranty:
- .1 Warrant the green roof space to be free of defects in labour, material and workmanship for a period of two (2) years from the date of Substantial Performance of the Work, and warrant to maintain same as per original growing medium and planting, and to replace defective plant material without cost to the building Owner.
  - .2 Re-plant/re-seed areas which have died or have developed an unhealthy condition within the first two (2) years of the warranty period.

**Part 2 PRODUCTS**

**SPEC NOTE:** Specify sheathing board only where CAN/ULC 126 - Fire Test of Roof Deck Components requiring sheathing is required for project. Standard determines spread of fire on the underside of roof deck and evaluates a roofing system's fuel contribution. Critical for buildings with large open interior space. Always recommend use of sheathing board over steel deck.

**2.1 SHEATHING SUBSTRATE:**

- .1 Thermal Barrier Underlay Board: 13 mm thick glass mat faced gypsum panel with water-resistant core, and meeting the following criteria:
  - .1 Combustibility: Non-combustible to ASTM E136.
  - .2 Surface Burning Characteristics: to ASTM E84, maximum flame spread of 0, smoke developed of 0.
  - .3 Manufacturer and Product Name: Dens-Deck Prime by G-P Gypsum.

**SPEC NOTE:** Include in specification if gypsum and/or roof insulation is to be adhered to steel deck or substrate. Very few adhesives meet these stringent requirements tested by Factory Mutual Global (FM) and Underwriters Laboratory of Canada (ULC) and pass wind uplift requirements of 1-90 psf with flame spread requirements.

- .2 Gypsum Adhesive: Single component, bitumen modified polyurethane adhesive, solvent free, meeting ULC and tested by Factory Mutual. Fas-N-Free by Tremco Canada.

**SPEC NOTE:** Include in specification if gypsum substrate is to be mechanically attached to steel deck.

- .3 Gypsum Fasteners: Provide flat-head, countersunk, self tapping screws, size, type and length in accordance with FMG requirements, corrosion-resistance provisions in FM 4470 with locking plastic plates or metal plates to CSA B35.3-1962 Tested by gypsum board manufacturer for required pullout strength.

**2.2 BITUMOUS MATERIALS**

- .1 Waterproofing Adhesive (Base Ply): Single component bitumen modified polyurethane TP-60 by Tremco.
- .2 Lap Reinforcement: Three course application of Rubberized Elastomer and Reinforcing Mesh; Polyroof SF and Burmesh by Tremco.
- .2 Primer: Water based single component asphaltic primer. Tremprime WB by Tremco.
- .3 Plastic Cement: Asphaltic synthetic rubber, Polyroof SF by Tremco Canada.

### 2.3 ROOF MEMBRANE

- .1 Roof Membrane (Top Ply): Polyester reinforced EPDM/SBR single ply membrane, 1.14mm (45 mils) thick TRA membrane by Tremco.

**SPEC NOTE:** Edit to suit project requirements. List other accessories here, e.g. traffic pads, prefabricated expansion joint covers, roof access hatches, roof vents, etc.

### 2.4 ACCESSORIES

- .1 Ballast: Round river stone: 1 ½ - 2 inch (38 - 50 mm) diameter free of fines and long splinters.

**SPEC NOTE:** Delete if wood cant is specified in Section 06100. Fibreboard cants not suitable at eaves unless solidly backed by wood or metal.

- .2 Fibre cant strips: asphalt impregnated wood fibreboard 75 x 75 x 38 mm (3 x 3x 1 ½ inches)
- .4 Pavers: 600 x 600 x 50 mm (24 x 24 x 2 inch) concrete pavers set on pedestals or pads.
- .5 Stack Flashings: Prefabricated aluminium sleeves as manufactured by Thaler Metal Industries or equivalent.
- .6 Drains: Prefabricated drains as manufactured by Thaler Metal Industries or equivalent.
- .7 Membrane Fasteners: 1" (25mm) square or round head, ring shanked galvanized or non-ferrous type, length as required to suit application.
- .8 Securement Bar: Continuous 3mm x 25mm (1/8" x 1") aluminium bar, predrilled for mechanical attachment.
- .9 Sealant: Single component roofing sealant Dymonic by Tremco.

**SPEC NOTE:** Optional item. The TRA roof membrane is a root barrier. However if large shrubs or small trees are specified the use of a polyethylene sheet is recommended.

### 2.5 ROOT BARRIER PROTECTION

- .1 Shall be a 10 mil. thick polyethylene sheet, no chemical root repellent.

## 2.6 INSULATION

- .1 Extruded polystyrene to CAN/CGSB - 51.20 Type 4, four (4) inches (50 mm) thick, R-20 total thermal performance, shiplapped for inverted roofing.

**SPEC NOTE:** The vapour diffusion mat is a requirement over Dow STYROFOAM if a capillarity mat is also specified. Not required if roof insulation is NOT specified.

## 2.7 VAPOUR DIFFUSION MAT

- .1 An air layer composed of a crush proof core and non-woven filter fabric.

**SPEC NOTE:** Optional item. Capillarity mat provides additional moisture retention and humidity characteristics. If cost is an issues delete capillarity and vapour diffusion mats.

## 2.8 CAPILARITY MAT

- .1 Is composed of high-quality, recycled, non-rotting, polypropylene fibers with a water retention capacity of 5 l/m<sup>2</sup>.

**SPEC NOTE:** All panels are strong enough to bear the weight of roof-top foot traffic during installation. Filling the cups with crushed clay brick enables the Hydrotech drainage/water retention panels to sustain the weight of light-duty earth moving equipment and soil depths greater than 225 mm (9 inches)

Pontarolo Windi does not require the drainage/water retention cups to be filled. The design allows for the weight of the light-duty earth moving equipment and soil depths greater than 225 mm (9 inches)

## 2.9 DRAINAGE/WATER RETENTION COMPONENT

- .1 Windidrain by Pontarolo Engineering, 100% recycled polypropylene, moulded into a three dimensional extensive/intensive panel that inter-connect to provide a self-bearing structure. Supplied by Tremco Canada

Compressive strength	6000 Kg/m <sup>2</sup> (9.0 Psi)
Water retention	10 L/m <sup>2</sup>
Dimensions	560mm x 560mm x 50mm

AND/OR

- .2 SW 25, 100% recycled polyethylene, moulded into a three dimensional extensive panel.

Compressive strength	ASTM D-1621	24,400 Kg/m <sup>2</sup>
Water retention	3 L/m <sup>2</sup>	
Dimensions	1 m x 2 m x 40 mm	

AND/OR

- .3 SW 40, 100% recycled polyethylene, moulded into a three dimensional extensive panel.

Compressive strength	ASTM D-1621	11,100 Kg/m <sup>2</sup>
Water retention	4 L/m <sup>2</sup>	

Dimensions 1 m x 2 m x 40 mm

AND/OR

- .4 SW 40, 100% recycled polyethylene, moulded into a three dimensional intensive panel with drainage aggregate.

Compressive strength ASTM D-1621 35,700 Kg/m<sup>2</sup>  
Water retention 4 L/m<sup>2</sup>  
Dimensions 1 m x 2 m x 40 mm

AND/OR

- .5 FD 60, 100% recycled polyethylene, moulded into a three dimensional intensive panel.

Compressive strength ASTM D-1621 3,200 Kg/m<sup>2</sup>  
Water retention 8 L/m<sup>2</sup>  
Dimensions 1 m x 2 m x 40 mm

AND/OR

- .6 Floradrain FD 60, 100% recycled polyethylene, moulded into a three dimensional intensive panel with drainage aggregate.

Compressive strength ASTM D-1621 54,300 Kg/m<sup>2</sup>  
Water retention 5 L/m<sup>2</sup>  
Dimensions 1 m x 2 m x 40 mm

**SPEC NOTE:** Optional. Drainage aggregate is dependant on soil depth, pedestrian traffic and choice of drainage/moisture retention panel. See above Spec Note.

## 2.10 DRAINAGE AGGREGATE

- .1 LaFarge #4643 lightweight Slag drainage medium or 12 mm crush brick.

## 2.11 GEOTEXTILE FILTER CLOTH

- .1 Systemfilter SF sheet made of non-rotting, non-woven polyethylene fiber, chemically neutral to all natural acids and alkalis or felt fabric LINQ 120EX NW Geo. 1.91m x 110m.

**SPEC NOTE:** The weights outlined below are for specific soil types. A soil type will depend on plant selection. Contact membrane manufacturer for specific weights.

**Semi-intensive "A"** (5-8 inches soil) 21.25 kg/m<sup>2</sup> (4.4 lbs/ft<sup>2</sup>) @ 25mm (1 inch)

**Semi-intensive "B"** (5-8 inches soil) 36.6 kg/m<sup>2</sup> (7.5 lbs/ft<sup>2</sup>) @ 25mm (1 inch)

**Extensive:** (4-6 inches soil) 16.25 kg/m<sup>2</sup> (3.3 lbs/ft<sup>2</sup>) @ 25mm (1 inch)

## 2.11 GROWING MEDIUM EXTENSIVE

- .1 Rooftop BioMix by Landsource Organix Ltd. (877)548 8558
- .2 Rooftop BioMix is a lightweight, soil-less mix of organic and inorganic material that will support plant growth.
- .3 Rooftop BioMix will contain at least 40% organic material, consisting of well-composted, stable and mature green organic

waste matter and composted pine bark. All compost material shall meet the Ontario Ministry of the Environment's Interim Guidelines for the Production and Use of Aerobic Compost in Ontario definition for Type A compost and shall be supplied from composting sites certified to meet the Ontario Ministry of the Environment's Compost Regulation 101.

- .4 Rooftop Biomix must include 5% concentration of GroFoam™, lightweight horticultural foam for structure and moisture retention.
- .5 Rooftop Biomix must be injected with Microblend™ microbial stimulant in order to bind the soilless mix on the roof surface and facilitate superior plant establishment.

**SPEC NOTE:** It is understood that with an organically dominated mix, physical parameters may fluctuate as the product changes over time.

- .6 Specifications:
  - .1 Organic Matter - Minimum 40%  
Maximum bulk density at saturation - 850 kgs./m3  
Water Retention - Minimum 20%  
Air Porosity - Minimum 15%  
pH - 6.0-7.4

**SPEC NOTE:** Vegetation is selected for its resistance to cold and dry extreme conditions. The vegetation can be sowed or planted

## **2.12 PLANT MIX**

- .1 Plants desired are to be selected by [landscape architects] [manufacturers consultant] in keeping with the overall plan intended.

## **2.13 INSPECTION CHAMBERS**

- .1 Aluminium, over-drain inspection boxes, with perforated sides and removable lids, as per manufacturer's details.

## **2.14 METAL FLASHINGS & SHEET METAL**

- .1 Provide all materials, fabrication and installation as described in Section 07600 Flashing and Sheet Metal, including but not limited to cap flashings, counter flashings, curb flashings, copings, etc.
- .2 Fasteners shall be supplied in accordance with the manufacturer's standard to meet the loading requirements and to maintain a weather tight installation. All exposed fasteners shall match the panel colour.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- .1 Inspect existing conditions to ensure they are suitable for roofing work to begin. Do not proceed until unacceptable conditions are corrected.

- .2 Ensure surfaces to receive roofing are clean and dry.
- .3 Ensure the work site ambient temperature is high enough after the vegetation is installed to prevent frost damage.

**3.2 SUBSTRATE PREPARATION:**

**SPEC NOTE:** Coordinate curing compounds with Section 033##- Concrete Floor Treatment. It may be necessary to specify sandblasting for the removal of the existing curing compound. Also coordinate concrete finish with Section 033##- Cast-in-Place Concrete. Concrete surfaces should receive a wood float finish or better and be cured a minimum of 14 days.

- .1 Ensure membrane substrate is rigid, dry, smooth, compatible, free of fins and sharp edges, and clean of all debris and foreign matter.
- .2 Verify that roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, and wood cant strips, wood nailing strips, and reglets are in place.
- .3 Applicator shall notify design authority and General Contractor in writing of unsuitable surfaces and working conditions. Commencement of work shall imply acceptance of surfaces and working conditions.

**3.3 PROTECTION:**

- .1 Protect adjacent work, building and property from damage during roofing operations.
- .2 Hang tarpaulins to protect walls where hoisting is necessary. Locate kettles so that smoke will not discolour building or adjacent buildings or enter air intakes. Keep masonry and finished surfaces clean and free bitumen.
- .3 Use wood planks or minimum 10 mm (3/8") thick plywood sheathing in work areas and along work routes as required to prevent damage to steel deck, or sheathing and roofing.

**3.4 PRIMER APPLICATION:**

- .1 Do priming of surfaces at the rate of 2.4-4.8 m<sup>2</sup>/litre(100-200 ft<sup>2</sup>/gal.) except where specified.
- .2 Prime wood, concrete, and metal surfaces to be directly adhered with bituminous membranes; allow to dry.

**SPEC NOTE:** Sheath over corrugated steel deck. Choose between mechanical attachment or fully adhere gypsum board to deck.

**3.5 SHEATHING (Mechanically Attached)**

- .1 Mechanically attach gypsum board to the deck with screws and plates using one (1) fastener per 3.2 square feet.
- .2 Stagger boards at least 300 mm (12 inches).
- .3 Drive fasteners flush to top surface.

- .4 Install boards with long axis perpendicular to ribs, with end joints fully supported.
- .5 Firmly butt each board to surrounding boards. Do not jam or deform boards.
- .6 Cut and fit boards where roof deck intersects vertical surfaces.
- .7 Filler boards shall be minimum 450 mm (18 inches) each direction and secured with a minimum two (2) fasteners per board.

### **3.6 SHEATHING (Adhered)**

- .1 If applied directly to deck, prime deck at the rate of 4.8 m<sup>2</sup>/l (200 ft<sup>2</sup>/gal).
- .2 Adhere gypsum board to the deck using the specified adhesive at the rate of 2.4 m<sup>2</sup>/l (100 ft<sup>2</sup>/gal).
- .3 Stagger boards at least 150 mm (6 inches).
- .4 Install boards with long axis perpendicular to ribs, with end joints fully supported if applied to steel deck.
- .5 Firmly butt each board to surrounding boards. Do not jam or deform boards.
- .6 Cut and fit boards where roof deck intersects vertical surfaces.
- .7 Filler boards shall be minimum 450 mm (18 inches) each direction.

### **3.7 CANT STRIPS**

- .1 Install cants at all intersections of roofing and vertical surfaces.
- .2 Embed in a continuous bed of cold adhesive applied to roof insulation.
- .3 Lay true to line, level and with flush, butt joints and accurate mitered corners.

### **3.8 ROOF MEMBRANE**

- .1 Plan the placement of roof membrane to facilitate the fabrication of the least number of seams, and to ensure that as water drains from the roof area, it will run over or along, but not against, shingle lap seams. Starting at the area's lowest level, unroll two sheets in adjacent parallel lines and position the uppermost sheet to overlap the adjacent sheet by 100 mm (4 inches).
- .2 Apply cold adhesive/ waterproofing membrane to the entire substrate at a minimum rate of 1.2 kg/m<sup>2</sup> (25 lbs per 100 sq. ft.) and also on top of the adjacent sheet 100 - 125 mm (4 - 5 inches). Immediately roll out the top sheet into the adhesive. Roll or broom the sheet to ensure that it is properly embedded, without wrinkles, blisters or fishmouths.
- .3 Plan the placement of elastomeric rubber membrane to facilitate the fabrication of the least number of seams, and to ensure that

as water drains from the roof area, it will run over or along, but not against, shingle lap seams. Starting at the area's lowest level, unroll two sheets in adjacent parallel lines and position the uppermost sheet to overlap the adjacent sheet by 100 mm (4 inches).

- .4 Install three course application of rubberized elastomer and reinforcing mesh over all side and end laps. Stripping shall extend 75 mm (3 inches) on either side of the lap edge. Install succeeding sheets in a similar manner.
- .5 Apply cold adhesive / waterproofing membrane over the lap such that the cold adhesive extends 50 - 75 mm (2 - 3 inches) on either side of the leading edge. Install succeeding sheets in a similar manner.
- .6 Ensure continuity of building envelope air barrier.

**SPEC NOTE:** Include if specified in Section 1.7.8.3

### **3.9 ELECTRONIC TESTING:**

- .1 Electronic Testing: Perform leak testing by an electronic detection process administered by a qualified testing agency.
  - .1 Test the entire roofing membrane on an area-by-area basis as required by the conduct of the Work. Wet the membrane test area with water or other suitable conductor fluid prior to start of each test and maintain wet for duration of testing.
  - .2 If leaks occur, remove existing components and replace with new materials to eliminate the causes and sources of the leaks.
- .2 Water testing: Perform non-destructive integrity tests utilizing electric field vector mapping (EFVM) technology. (1-866-282-5325)
  - .1 Test water tightness of the membrane by blocking off membrane in convenient areas with a suitable waterproof temporary curb, temporarily plugging drain outlets, and flooding with water to a depth of 100 mm. Allow water to stand for 48 hours.
  - .2 Remove defective Work, relay new membrane, and repeat test.
  - .3 On completion of testing, remove water and curbs, unplug drains, and leave surfaces in a clean and tidy condition.

**SPEC NOTE:** Include if specified in Section 2.5

### **3.10 ROOT BARRIER PROTECTION**

- .1 Install a layer of Root Protection, lapping adjacent sheets 1,5 m over the separation sheet. The Root Protection must be turned up all vertical, roofed/flushed surfaces to completely protect waterproofing and flashings.

### **3.11 FLASHINGS**

- .1 Membrane flashings shall be installed in accordance with the manufacturer's requirements.

- .2 Flashings shall be installed to ensure the roof is watertight at the end of each day.
- .3 Extend base ply of flashing a minimum 4 inches onto the roof membrane. Extend flashing 2 inches beyond the edge of the base ply flashing.
- .4 Extend flashings a minimum 8 inches up walls.
- .5 Fasten flashings at 8 inches on centre. Secure all vertical flashings through a termination bar.

### **3.12 INSULATION**

- .1 Prior to application of green roof system, contractor shall inspect roof with consultant. All defects will be repaired prior to the application of the remaining components.
- .2 Install 150 mm (6 inch) wide polyethylene slip sheet over mastic applied at all edge and end laps.
- .3 Install insulation to maintain continuity of thermal envelope.
- .4 Fit insulation tight around roof penetrations.
- .5 Firmly abut the insulation boards to surrounding boards. Do not jam or deform boards. Use largest possible pieces to minimize joints.
- .6 Minimize elevation variation between boards at joints to provide level surface to accommodate subsequent surfacing.
- .7 Stagger joints at least 300mm (12 inches).

**SPEC NOTE:** Include if specified in Section 2.7. When insulation **and** moisture retention mat are specified an air layer is required between the surface of the insulation and the retention mat.

### **3.13 VAPOUR DIFFUSION MAT**

- .1 Install mat over the insulation. The 100 mm salvage edge of the geotextile fabric overlaps adjoining sheets and can be held in place with duct tape.

**SPEC NOTE:** Include if specified in Section 2.8

### **3.14 CAPILARITY MAT APPLICATION**

- .1 Install mat over the root barrier [when no insulation is specified] [air layer/ insulation], lapping adjacent rolls a minimum of 100 mm. The mat must be turned up all vertical, roofed/flashed surfaces a minimum of 150 mm beyond the anticipated soil level. Any excess will be trimmed down to the level of the soil.

**SPEC NOTE:** Installation requirements 3.14.1 - 3.14.2 apply to Floradrain FD drainage/moisture panels as specified in 2.9.2 - 2.9.6

**SPEC NOTE:** When specifying a semi-intensive or intensive green roof with FD40 and/or FD60 drainage/moisture retention panels the cups of the panels must be filled with crushed, expanded clay or equivalent mineral soil. This prevents

the filter cloth from collapsing into the cups due to the weight of the growing medium and pedestrian foot traffic.

### **3.15 DRAINAGE/WATER RETENTION COMPONENT**

- .1 Install the drainage/water retention component over the [capillary mat],[insulation] [membrane] butting adjacent panels approximately 25 mm and fixing together with staples/clips, cut to fit around penetrations, etc. with a heavy duty utility knife or small toothed saw.

**SPEC NOTE:** As required.

- .2 Fill the cups of the drainage/water retention component, level with the top of the panel, with slag.

**SPEC NOTE:** Installation requirements 3.143.3 - 3.14.4 apply to Pontarolo Windi drainage/moisture panels as specified in 2.9.1

- .3 Install the aerated, drainage/water retention component over the [membrane] [insulation]. Commence installation, beginning from the first row, always starting from left to right. Repeat on all other rows and secure the joints.
- .4 Cut to fit around penetrations with a small toothed saw.

### **3.16 GEOTEXTILE**

- .1 Apply continuous layer of filter fabric, un-bonded over installed insulation lapping joints 300 mm minimum.
- .2 Cut fabric around drains, vents and other penetrations and extend up protrusions and place under metal flashings.
- .3 Lap edges of fabric a minimum of 300 mm (12 inches).
- .4 Enough material should be left to enable it to be drawn up above the anticipated soil level. Any excess will be trimmed down to the level of the soil.

### **3.17 INSPECTION CHAMBERS INSTALLATION**

- .1 Put directly on the drainage/water retention component the inspection chamber.
- .2 Use some river stone on the perimeter of the inspection chamber to keep it free of any vegetation.

### **3.18 GROWING MEDIUM - GENERAL**

- .1 Installation shall be achieved by way of pneumatic blower truck to minimize excess compaction of the growing medium.
- .2 The pneumatic blower truck shall be a custom manufactured, fully integrated, truck-mounted unit. The blower truck shall be equipped with a PLC calibrated injection system.
- .3 The unit shall be capable of uniformly applying materials and injected products at a rate greater than 0.15 cubic meters of material per minute up to a vertical limit of 45 meters. The blower truck shall also be equipped with an application hose

capable of extending 90 meters from the blower truck unit. Contractor must have a minimum five (5) years proven experience in the application of using a Blower Truck.

**SPEC NOTE:** A minimum thickness of lightly compacted 150 mm growing medium is generally recommended for the climatic zones of 5 and below.

### **3.19 GROWING MEDIUM - EXTENSIVE**

- .1 Spread uniformly the growing medium for extensive green roof in a uniform way on the geotextile cloth.
- .2 Verify the thickness in several points with a tolerance not greater than  $\pm 10$ mm.
- .3 Spread and incorporate into the first centimetre of the surface, according to the [landscape architects] [manufacturers consultant] acceptance.
- .4 Level, spray water till soil medium is saturated and pass a roller to the surface. The minimal thickness of the substratum shall be [150 - 300][ ]mm after compaction.
- .5 Remove at once the compost and the fragments spread on the surfaces not used and clear from the construction site all harmful materials.

### **3.20 PLANT INSTALLATION**

- .1 Before installation of the vegetation, verify the finished grade of the growing medium.
- .2 Supply vegetation in strict accordance with [landscape architects] [manufacturers consultant] requirements or with the instructions, plans and good practice.
- .3 Water the plants/seed bed to the point of saturation immediately after installation.

### **3.21 HARD SCAPE / ACCESSORY INSTALLATION**

- .1 Install strips/areas of [stone] [paver] ballast for walkways and maintenance paths and at all roof perimeters, building walls, penetrations, and access hatches to act as vegetation barriers for the flashings as well as safety strips (wind, fire).
- .2 Spread required amount of stone ballast in a uniform fashion 500mm around perimeter of roof edge and projection through roof assembly.
- .3 Installed ballast mass to a minimum 100 kg/m<sup>2</sup>
- .4 All drains to be fitted with an inspection/ maintenance boxes and grills, built up to ensure access at soil level.

### **3.22 MAINTENANCE OF THE GARDEN ROOF**

- .1 Ensure the maintenance of garden roof surfaces till the end of the period of guarantee.

- .2 Execute the maintenance mentioned below between the date of installation of the vegetation and the date of acceptance of the works by the architect.
- .3 Water: The growing medium shall be maintained wet during the period of setting-up, for at least two months after planting or sowing to a depth from 75 to 100 mm. Reduce irrigation to stimulate the resistance of compost due to the aridity and the cool temperatures.
- .4 Fertilization: spread uniformly an organic fertilizer or an amendment after 6 months and twice yearly thereafter.

**SPEC NOTE:** An application of organic fertilizer or amendment designed for slow liberation is recommended at the beginning of every summer.

- .5 Transplant or re-sow again the places where plants died.
- .6 Weeding: Weed once a month before the complete coverage of the vegetation.
- .7 Inspection of drains: inspect and clean drains from two times a year with especially at the beginning and at the end of season.

**3.23 SPOT QUALITY CONTROL**

- .1 The inspection and the attempts of the membrane in rubberized asphalt applied to warmth will be made by the test laboratory indicated(appointed) by the architect [ the consultant] [ the engineer], according to the prescriptions of the section [01450 - Quality control] [01001 - general Requirements].

**3.24 CLEANING**

- .1 Clean work in accordance with Section [01740 - Cleaning].
- .2 Clean to [Engineer's] [Consultant's]approval, soiled surfaces, spatters, and damage caused by work of this section.
- .3 Check area drains to ensure cleanliness and proper function, and remove debris, equipment and excess material from site.

**End of Section**