

**SECTION 32 95 00**  
**EXTENSIVE VEGETATED ROOF COVER ASSEMBLY**

Hazard Branch Library and Erie Canal Museum Green Roofs

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section specifies all labor, materials, transportation, equipment and services necessary to assemble a complete Type I assembly, as provided by Roofmeadow, shown on the Drawings and described herein. This system shall be installed in conjunction with a compatible waterproofing system.

**1.2 Related Work Under Other Sections**

- A. Section 07 13 54 - Thermoplastic Sheet Waterproofing

**1.3 REFERENCES**

- A. Referenced standards and abbreviations
  1. System Provider's specifications and recommendations.
  2. American Standard Testing Method Standards – abbreviated as “ASTM.”
  3. ASTM E2396: Standard Testing method for Saturated Water Permeability of Granular Drainage Media [Falling-Head Method] for Green Roof Systems
  4. ASTM E2399: Standard Testing Method for Maximum Media Density for Dead Load Analysis
  5. ASTM D5199: Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
  6. ASTM D4833: Standard Test Method for Index Puncture resistance of Geotextiles, Geomembranes, and Related Products
  7. ASTM D5261: Standard Test Method for Measuring Mass per Unit Area of Geotextiles
  8. ASTM E2397: Standard Practice for Determination of Dead Loads and Live Loads Associated with Green Roof Systems
  9. ASTM C131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  10. ASTM C88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
  11. ASTM C29M: Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate
  12. ASTM C136: Standard Test Method for Sieve analysis of Fine and Coarse Aggregates
  13. ASTM D3776: Standard Test Methods for Mass per Unit Area (Weight) of Fabric
  14. ASTM D4632: Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

15. ASTM D4491: Standard Test Methods for Water Permeability of Geotextiles by Permittivity
16. ASTM D422: Standard Test Method for Particle-Size Analysis of Soils
17. ASTM D5035: Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
18. ASTM D1777: Standard Test Method for Thickness of Textile Materials
19. ASTM D4716: Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
20. ASTM D3786: Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
21. ASTM D1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics
22. ASTM C40: Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
23. ASTM C140: Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
24. ASTM C67: Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
25. UL Inc.: Class a Classification for use in Ballasted Systems.
26. Methods of Soil Analysis, American Society of Agronomy (1996) - abbreviated as "MSA."
27. Test Methods for the Examination of Composting and Compost (latest) – abbreviated as "TMECC."
28. Recommended Chemical Soil Testing Procedures, North Central Region Publication #221 – abbreviated as "RCSTP."
29. USDA Handbook #60 – abbreviated as "USDA."
30. Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. [The Landscaping and Landscape Development Research Society], methods to be based on the latest English edition – abbreviated as "FLL."

#### 1.4 DEFINITIONS

- A. **Drain Access Chamber:** Open-ended box or cylinder that covers drains and/or scuppers. The chamber must be designed to admit water freely at the base. It must also have a removable lid to prevent debris from entering the chamber. The choice of chamber type will depend on the type of deck drain or scupper in use. See 1.5 Submittals.
- B. **Drain Conduit:** Perforated or slotted conduit installed in the drainage layer that is used to intercept and drain away percolating rainfall during design storm events.
- C. **Drawings:** Plans, sections and details included in the contract documents of which this Specification is a part.
- D. **Growth Media Layer:** An engineered soil-like material designed to retain moisture, manage plant nutrients, and support vigorous growth of the foliage.
- E. **EFVM® (Electric Field Vector Mapping®):** A leak location technique that relies on the electrical conductivity of the cover material (moist media) and electrical insulating

properties of the waterproofing membrane. The compatibility of EFVM® with a specific waterproofing system must be established in advance by the EFVM® service provider.

- F. **Manning formula for conveyance** ( $\text{ft}^3/\text{s}$ ):  $K = (1.49 \times A \times R^{(2/3)})/n$ ;  
A=area ( $\text{ft}^2$ ), R=hydraulic radius (ft), n=Manning's roughness coefficient (dimensionless).
- G. **Root-Barrier:** A thermoplastic membrane designed to prevent root penetration of the underlying waterproofing and to retain moisture in the root zone.
- H. **System Provider:** Company that provides or certifies all materials required for installation of the vegetated roof cover assembly, furnishes on-site coordination and inspection, and offers long-term support for the completed vegetated roof cover assembly. That company shall be *Roofmeadow*.
- I. **Waterproofing Provider:** Company that provides or certifies all materials required for installation of the building waterproofing, furnishes on-site coordination and inspection, and offers long-term support and warranty protections for the completed waterproofing, including flashings, counter-flashings, coping, and deck drains. This company is *Sika Sarnafil*.

## 1.5 SYSTEM DESCRIPTION

- A. Design Requirements
  - 1. The vegetated cover assembly shall be a single-media system, consisting of 2.5 inches of growth media layer installed over a synthetic moisture management layer.
  - 2. The total assembly thickness shall be 3.5 inches.
  - 3. The basis of design is Roofscapes, Inc. Type I green roof assembly
  - 3. The Type I assembly is intended to be used without irrigation.
  - 4. This assembly is suitable for roofs with pitches ranging from 1/8:12 (0.6 degrees) to 2:12 (9.5 degrees). Assemblies installed on pitches steeper than 2:12 (9.5 degrees) will require supplemental slope stabilizing measures.
  - 5. This assembly is not compatible with pedestrian access other than for maintenance activities.
- B. Performance Requirements: Vegetated roof covering system shall:
  - 1. Support a perennial vegetated ground cover.
  - 2. Provide efficient drainage of moisture that is in excess of that required for the vigorous growth of the installed vegetation.
  - 3. Protect roof waterproofing materials from damage caused by exposure to ultraviolet radiation, physical abuse, and rapid temperature fluctuations.
  - 4. Retain 1 inch of moisture at Maximum Water Capacity, in accordance with the referenced ASTM E-2397 standard.
  - 5. The wet dead weight of this system shall not exceed 15 pounds per square foot (ASTM E-2397).
  - 6. The minimum dry weight of the assembly shall not be less than 9 psf.
  - 7. Continue to perform as designed for the duration of the warranty period, without a requirement to replace, amend or refresh the media.

1.6 SUBMITTALS

A. Product Data:

1. System Provider’s technical literature showing compliance of all components with specified requirements. Documents shall be clearly marked to indicate all technical information which specifies full compliance with requirements of this section and Contract Documents.
2. System Provider’s statement indicating that proposed use is appropriate for each product.
3. System Provider’s statement that it has reviewed and approved the details for the associated waterproofing system, including deck drains, flashings, penetrations, and copings.

B. Shop Drawings:

1. Details of installation, showing conditions at terminations, transitions, drains, scuppers, and penetrations (if different from or supplemental to the Drawings).
3. Fabrication shop drawings for paver platform

C. Samples:

<u>Item No.</u>	<u>Quantity</u>	<u>Size</u>	<u>Description</u>
S1	1	4x4”	Synthetic sheet components, including fabrics, sheet drains, reinforcing materials, and wind protection materials
S2	1	12”	Drainage conduit.
S3	1	6 oz	Growth media for initial approval by the Architect.
S4	20 lbs		Washed stone, for initial approval by the Architect
S5	1	4”x4” sample	Concrete paver, for initial approval by the Architect

D. System Certification: Signed by the System Provider, certifying that

1. The submitted vegetated roof covering system complies with the specified system requirements (See 1.5 System Description).

E. Waterproofing Certification: Signed by the Waterproofing Provider, certifying that:

1. The proposed vegetated roof cover assembly is fully compatible with the waterproofing assembly and is eligible for the specified warranty.
2. The finished waterproofing has been tested under the direction of the Waterproofing Provider, using a method approved by the System Provider, and shall be certified as watertight by the Waterproofing Provider prior to installation of the vegetated cover. This test shall be included under the scope and budget of the Roofing Applicator.

3. The waterproofing system will not require a supplemental root-barrier (if a The Waterproofing Provider requires a root-barrier, then the method of protecting the waterproofing from root-related damage shall be recommended by the Waterproofing Provider and approved in writing by the System Provider.)
- F. Maintenance Program: Shall clearly describe the procedures for maintaining the vegetated roof assembly, including a maintenance schedule for the first 24 months. The schedule must include a minimum of six documented maintenance visits.
- G. Affidavit: Signed by the System Provider, stating that the installation contractor is licensed by the System Provider to install the assembly.
- J. Final Plant List: For approval by the Architect.
- K. Completed Dead Load Worksheet (ASTM E2397).

#### 1.7 DELIVERY, HANDLING, STORAGE

- A. Sedum cuttings shall be shipped to the site in cartons. The shipping time shall not exceed 24 hours. Upon receipt the cartons should be immediately opened (do not moisten). If installation of the cuttings will be delayed until the following day, empty the contents of the cartons and spread the cuttings onto a moistened non-woven fabric or felt. The cutting should be stored in a shaded but sunlit area, sheltered from the wind.
- B. Bulk earth materials shall be laid down on a tarp and covered with a tarp to minimize contamination, protect them from weed seed infiltration and maintain them in a dry condition.
- C. Synthetic components shall be accompanied by identifying labels. They shall be stored out of direct sunlight.
- D. Pavers and masonry materials shall be palletized, shrink-wrapped, and in a safe and secure location.

#### 1.8 QUALITY ASSURANCE

- A. Warranty
  1. 20-year Single-Source warranty for all work completed under this section shall be provided by the Waterproofing Provider to the Owner at the point of substantial completion (Section 07 13 54).
  2. Two-year Workmanship Warranty shall be provided by the Vegetated Roof System Contractor to the Owner and shall cover:
    - a. Workmanship and maintenance-related activities and components that shall be redone or removed and replaced at no cost to the Owner if, within the first twenty-four months after substantial completion, they are determined to be defective or not in accordance with contract documents.
    - b. The Vegetated Roof System Contractor shall pay for the cost of removing the vegetated cover, exposing and repairing the membrane, and restoring the vegetated cover, provided:

- i. The System Provider approves the method and technician for leak location.
    - ii. A representative of the System Provider is present to observe the removal of the vegetated cover.
    - iii. The leak is attributable to physical damage caused by activities of the Vegetated Roof System Contractor.
  - c. The cost for the two years of maintenance under this Workmanship Warranty shall be included in the installation price and paid in advance to the Vegetated Roof System Contractor.
- B. The work of this section shall be performed by a company that is licensed by the System Provider to perform vegetated roof assembly installation work.
- C. Integration
  - 1. All scope items related directly or indirectly to the vegetated cover system shall be provided by one contractor. Tasks in addition to those specifically mentioned in this Specification may include the installation of:
    - c. Stone and Paver ballast
- D. System Provider's Field Supervision
  - 1. The System Provider shall furnish a quality control specialist to observe critical aspects of the installation.
- E. Laboratory
  - 1. Tests shall be conducted by an independent laboratory with the experience and capability to conduct the tests indicated. These may include, but are not limited to:
    - a. A& L Great Lakes Laboratories, Inc. 3504 Conestoga Drive, Fort Wayne, IN 46808-4413 [260-483-4759]
    - b. *For specified FLL and ASTM test procedures:* Agricultural Analytical Services Laboratory, Penn State University, Tower Road, University Park, PA 16802 [814-863-0841]
    - c. *For specified FLL and ASTM test procedures:* Turf Diagnostics & Design, 613 E. 1<sup>st</sup>, Linwood, KS 66052 [913-723-3700]  
www.turfdiag.com

## 1.9 CONTRACT CLOSEOUT

- A. Signed warranty documents.

## PART 2 MATERIALS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. General: For the purpose of establishing the minimum functional, aesthetic and quality standards required for work of this section, products shall be certified by the System Provider:
  - 1. Roofmeadow, 7135 Germantown Avenue, Second Floor, Philadelphia, PA 19119

### 2.2 FOUNDATION/PROTECTION FABRIC *(to be placed under the DRAIN CONDUIT, and at all surfaces not covered by the MOISTURE MANAGEMENT/PROTECTION LAYER)*

- A. 8-ounce per square yard polypropylene or polyester non-woven needled fabric.

Density (ASTM-D3776)	$\geq 18 \text{ oz/yd}^2$
Puncture Resistance (ASTM D-4833)	$\geq 180 \text{ lbs}$

### 2.3 DRAIN CONDUIT

- A. Rectangular slotted low-profile conduit.

Height	$\leq 2.25 \text{ in}$
Cross-Section area	$\geq 6 \text{ in}^2$
Open area (slots and perforations)	$\geq 12 \%$
Hydraulic conveyance (K)	$\geq .9 \text{ ft}^3/\text{sec}$

### 2.4 MOISTURE MANAGEMENT/PROTECTION LAYER

- A. Geosynthetic Composite Sheet. This material is composed of post-industrial recycled closed-cell polyethylene foam with bonded separation fabric.

Thickness	1 in
Transmissivity (between platens) (ASTM-D4716) (confining normal stress of $\geq 150 \text{ psf}$ )	5-17 gal/min/ft *
Compression Yield Strength (10% strain)	$\geq 250 \text{ lb/ft}^2$
Static Puncture Resistance (EN-ISO-12236)	$\geq 415 \text{ lb}$
Tensile Strength (EN-ISO-10319)	$\geq 180 \text{ lb/ft}^2$
* Referred to a hydraulic gradient of 1.0	

### 2.5 SEPARATION FABRIC

- A. Root-permeable needled non-woven polypropylene or polyester separation fabric. The component shall satisfy the following specifications:

Permittivity (ASTM-D4491)	$\geq 1.5 \text{ sec}^{-1}$
Weight (ASTM -D5261)	4-6 oz/yd <sup>2</sup>
Puncture Resistance (ASTM-D4833)	$\geq 50 \text{ lb}$
Mullen Burst Strength (ASTM-D3786)	$\geq 160 \text{ lb/in}^2$
Grab Tensile (ASTM D-4632)	$\geq 120 \text{ lb}$

### 2.6 GROWTH MEDIA LAYER

- A. Extensive growth media. This material is a mixture of mineral and organic components that satisfies the following specifications:

Non-Capillary Pore Space Ratio at	$\geq 6\%$
Maximum Water Capacity (FLL or ASTM-E2399)	
Maximum Water Capacity (FLL or ASTM-E2399)	$\geq 35\% \text{ (vol)}$
Density at Maximum Water Capacity (ASTM-E2399)	$\leq 58 \text{ lb/ft}^3$
Saturated Hydraulic Conductivity	0.10 – 2.0 in/min

(FLL or ASTM-E2399)	
Alkalinity, Ca CO <sub>3</sub> equivalents (MSA)	≤ 2.5%
Total Organic Matter, loss on ignition method (MSA)	4-10% (dry wt.)
pH (RCSTP)	6.5 – 8.0
Soluble Salts (DPTA saturated paste extraction) (RCSTP)	≤ 6 mmhos/cm
Organic Supplements (compost, peat moss, etc.) combined respiration rate (TMECC 05.08, B)	≤ 2 mg CO <sub>2</sub> /g TOM/d
Cation exchange capacity (MSA)	≥ 10 meq/100g
Grain-size distribution of the mineral fraction (ASTM-D422)	
Clay fraction (2 micron)	≤ 2%
Pct. Passing US#200 sieve (i.e., silt fraction)	≤ 5%
Pct. Passing US#60 sieve	≤ 10%
Pct. Passing US#18 sieve	5 - 50%
Pct. Passing 1/8-inch sieve	30 - 80%
Pct. Passing 3/8-inch sieve	75 -100%
Total Nitrogen, TKN (MSA)	25-100 ppm
Phosphorus, P <sub>2</sub> O <sub>5</sub> (Mehlich III)	20-200 ppm
Potassium, K <sub>2</sub> O (Mehlich III)	≥ 150 ppm
Other macro- and micro-nutrients shall be incorporated in the formulation in initial proportions suitable for support the specified planting.	

- B. Thoroughly blend at a batch facility. Moisten, as required, to prevent separation and excessive ‘dusting’ during installation.
- C. Quality control samples shall be collected for each 100 CY provided to the job. These samples shall be sealed in 2 gallon water-tight containers and held by the contractor for inspection by the Owner’s representative.

2.7 PLANTS

- A. Sedum Cuttings
  - 1. Freshly cut Sedum
  - 2. Ship so that the cuttings are enclosed for no more than 30 hours.
  - 3. Sedum varieties (in approximately equal quantity):
    - S. sexangulare
    - S. floriferum Weihenstephaner Gold
    - S. spurium Whiteform
    - S. spurium Schorbusterblut
    - S. spurium Red Carpet
    - S. album spp
    - S. rupestre Angelina
    - Phedimus (formerly Sedum) takesimensense

2.8 WIND PROTECTION

- A. Temporary Wind Blanket composed of biodegradable coir. This blanket shall be secured using a method approved by the System Provider.



Tensile Strength (ASTM D-5035)	$\geq 100$ lb/ft
Unit Weight (dry)	$\geq 8$ oz/sy

2.9 BORDER UNITS

These units are used to contain soil, mineral materials, or pavers. To allow free flow across edges, these units should always be installed on top of moisture management/protection layer or sheet drain.

- A. Cantilever-type (i.e., 'L-shaped') border units. These are fabricated from 1/8 inch aluminum. Connectors link adjacent lengths.

Height	3 inches
Base Length	$\geq 3$ inches

2.10 SHEET DRAIN LAYER

- A. Sheet drain shall be a three-dimensional dimpled polyethylene or polystyrene sheet with a polypropylene or polyester fabric bonded to one side.

- B. Sheet drain shall have an adhered polypropylene, non-woven separation fabric.

- C. Properties:

1. System Thickness (ASTM D 1777):  $\leq 0.45$  in
2. Transmissivity (ASTM D 4716): 15-20 gal/min/ft @500 psf confining pressure and  $i=1$
3. Fabric:
  - a. Permittivity (ASTM D 4491):  $\geq 1.0$  sec<sup>-1</sup>
  - b. Puncture Resistance (ASTM D 4833):  $\geq 35$  lb
  - c. Grab Tensile (ASTM D-4632):  $\geq 120$  lb

2.11 MARGIN PAVERS

- A. Concrete turf paver composed with rectangular apertures, satisfying the following specifications:

Width	$\geq 15$ in
Thickness	$\geq 3$ in
Weight	20-24 lb/ft <sup>2</sup>
Open Space	$\geq 40$ %
Aperture size	$\geq 12$ in <sup>2</sup>

2.12 LIGHTWEIGHT DRAINAGE MEDIA

- A. Non-carbonate mineral granular materials, satisfying.

Density at Maximum Water Capacity (ASTM-E2399-05)	≤ 58 lb/ft <sup>3</sup>
Water Permeability (ASTM E2396-05)	≥25 in/min
Total Organic Matter, by loss on ignition (ASTM-F1647)	≤ 1%
Abrasion Resistance (ASTM-C131-96)	≤ 25% loss
Soundness (ASTM-C88 or T103 or T103-91)	≤ 5% loss
Porosity (ASTM-C29)	≥ 20%
Alkalinity, CaCO <sub>3</sub> equivalents (ASTM-F1647)	≤ 1 %
Grain-Size Distribution (ASTM-C136)	
Pct. Passing US#18 sieve	≤ 1%
Pct. Passing ¼-inch sieve	≤ 30%
Pct. Passing 3/8-inch sieve	≥ 80%

### 2.13 DRAIN ACCESS CHAMBERS

- A. PVC Drain Inspection Chamber is a 4 inch tall round chamber with removable lid. The diameter is 15 inches nominal. The chambers have no bottom panels; a vent on the removable lid, and knock-outs on the side panels for insertion of drain conduit. Conduit is used to enhance flow into or out of the chamber. Chambers shall be installed over all drains (in vegetated roof areas) and surrounded by a 12-inch stone margin.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install each component of the vegetated cover system in accordance with the System Provider's published instructions and Contract Documents.

### 3.2 INSPECT WATERPROOFING

- A. Examine the completed waterproofing system, with the Roofing Applicator present, for compliance with drawings, installation tolerances, and other conditions affecting performance.
  - 1. For the record, prepare a written report, endorsed by the Roofing Applicator and the Vegetated Cover Installer. As appropriate, list conditions that may be detrimental to the performance of the work.
  - 2. Proceed only after unsatisfactory conditions have been corrected.

### 3.3 PREPARE SURFACE

- A. The surface of the waterproofing system shall be swept and washed.
- B. Until the drainage media course is installed, traffic over the working area shall be strictly controlled and limited to essential personnel, only.
- C. Heavily traveled areas (e.g., corridors for transporting media to the working areas) must be protected in a manner approved by the Waterproofing Provider.

- D. Suitably protect laydown areas using ½-inch plywood or particle board over 1-inch sheets of expanded polystyrene (EPS), or similar sheathing material.

#### 3.4 INSTALL FOUNDATION/PROTECTION FABRIC

- A. Layout protection fabric along alignments for drainage conduit, and to protect membrane that would otherwise be exposed to the growth media.
- B. Hold in place using water-filled bags, or equivalent. If work is discontinued over night, stabilize using water-filled ballast bags or equivalent.

#### 3.5 INSTALL INTERNAL DRAINAGE CONDUIT

- A. Assemble the internal drainage conduit according to the layout provided by the System Provider.
- B. Cover the assembled conduit using separation fabric.
- C. The conduit will be completely concealed below the top of the growth media when properly installed.

#### 3.6 INSTALL MOISTURE MANAGEMENT / PROTECTION LAYER

- A. But sheets together in a manner that will preserve the continuity of the drainage channels. Do not overlap or interlock adjacent panels.
- B. Seams should be covered by fabric with a minimum 2-inch overlap on each panel. Employ separation fabric, as appropriate to cover all seams.

#### 3.7 INSTALL BORDER UNITS AND TURF PAVERS

#### 3.8 INSTALL DRAIN ACCESS CHAMBERS

#### 3.9 INSTALL LIGHTWEIGHT DRAINAGE MEDIA

#### 3.10 INSTALL GROWTH MEDIA

- A. Place the growth media layer. The media shall be dispensed at the roof level in a manner that will not suddenly increase the load to the roof. It shall be immediately spread to the specified thickness, plus ten percent, after moderate compaction. Unless otherwise approved, compaction shall be using a 4-foot wide lawn roller with a total load of not less than 200 lbs and not more than 300 lbs.
- B. Thoroughly soak with water using a sprinkler or hand sprayer.

#### 3.11 PLANT VEGETATION

- A. Planting using Sedum cuttings can be undertaken in most temperate climates from April 1 through May 1 and from September 15 through October 30. When installed outside this window during summer, regular watering will be required until the plants are rooted and

established. If plant installation cannot occur between April 1 and October 30, cover media with temporary wind protection as directed by the System Provider. *Specify supplemental cost associated with winter protection and subsequent spring mobilization for planting.*

- B. Place Sedum cuttings over all areas. Thoroughly mix Sedum cuttings and distribute at the rate of 40 lbs/1000 square feet.
- C. If more than 24 hours has elapsed since installing and soaking the growth media, thoroughly re-soak the growth media prior to commencing the broadcast distribution of seed or cuttings.
- E. Immediately cover temporary wind blanket and secure according the directions of the System Provider.

### 3.14 PROVIDE 2-YEAR MAINTENANCE SERVICE

- A. The vegetated roof assembly installer shall offer a two-year maintenance service. This service will include:
  - 1. Hand weeding and/or chemical weeding and fertilization, as required to maintain the health and vigor of the plants.
  - 2. Furnish written maintenance reports to the System Provider and Owner
  - 3. Install a temporary irrigation system for use, as needed, during the first growing season.

END OF SECTION

**SECTION 07 13 54**  
**THERMOPLASTIC SHEET WATERPROOFING**

Hazard Branch Library and Erie Canal Museum Green Roofs

**PART 1 GENERAL**

1.01 DESCRIPTION

A. Scope:

1. Install an adhered thermoplastic PVC membrane Waterproofing System manufactured utilizing a spread coat process with fiberglass reinforcement with integral flashings and other components.

Basis of Design Sika Sarnafil, Canton, MA, or approved equal.

2. The work includes, but is not limited to, the following:

- a. Substrate preparation.
- b. Grounding screen.
- c. Cover board.
- d. Waterproofing membrane.
- e. Membrane flashings and copings.
- f. Metal flashings and capping.
- g. Wood blocking.
- h. Sealants and adhesives.

B. Related Work Under Other Sections:

1. Section 32 95 00 – Extensive Vegetated Roof Cover Assembly.

1.02 QUALITY ASSURANCE

- A. The Waterproofing System shall be installed only by an Installer authorized by approved Waterproofing Manufacturer. Installer shall be certified by the Waterproofing Manufacturer prior to bid.
- B. Installation of all Waterproofing System components up to and including the waterproofing membrane shall be the responsibility of the Installer to ensure undivided responsibility.
- C. Obtain primary waterproofing, membrane, flashings, and appurtenances from a single waterproofing system manufacturer with not less than 20 years of successful experience in waterproofing applications. Provide other system components only as approved by Waterproofing Manufacturer.

- D. Pre-construction conference to be held with the owner, Engineer, Applicator's field superintendent, waterproofing foreman, Waterproofing Manufacturer's representative, landscaper, and other involved trades to discuss waterproofing practices applicable to the project.
- E. There shall be no deviation made from the contract specification or the approved shop drawings without prior written approval by the Owner or the Owner's Representative, and/or design professional, and Waterproofing Manufacturer.
- F. The Installer shall follow Manufacturer's Required Quality Assurance Procedures for Adhered Membrane. Contractor shall notify Engineer and Owner a minimum of forty-eight (48) hours in advance of its intent to commence work in order to allow the Design Professional the opportunity to examine and inspect the existing conditions prior to the application of new roofing.
- G. Waterproofing Manufacturer Representative shall inspect installation during and after roof application and submit written certification to Engineer that installation is in conformance with specifications. Waterproofing Manufacturer's Representative shall attend job meetings and submit written reports of all inspections on a weekly basis. No final payment will be made without written reports. Installation of entire assembly shall be in accordance with Factory Mutual Construction Bulletin 1-29, latest edition issue for Factory Mutual Class I Construction.
- H. Waterproofing Installers Qualifications:
  - 1. Installer shall have been roofing business continuously for a minimum of five years under the same company name.
  - 2. Installer is certified by Waterproofing Manufacturer of the roofing products prior to bid.
  - 3. Installer shall have installed the specified waterproofing system on at least three projects that are currently at least 5 years old with no workmanship failures.
  - 4. Installer shall have at least three jobs in size not less than 80% of this project size completed within past 5 years
- I. Waterproofing Manufacturer Qualifications:
  - 1. Waterproofing Manufacturer of selected Waterproofing System shall have product in use in the continental United States continuously for a period of not less than 10 consecutive years.
  - 2. Waterproofing Manufacturer of selected Waterproofing System shall have not less than five million square feet fully installed for not less than 7 years.

3. The selected Waterproofing System shall have been manufactured as submitted for not less than seven years without significant (less than 3%) chemical change or physical change of any kind. Furnish Waterproofing Manufacturer's certification.
  4. Waterproofing Manufacturer's Representative shall provide roofing inspection service by qualified technical, non-sales representative, for 1st work day of roofing for each roof and then weekly visits to site during installation to review installation procedures and to advise on procedures and precautions in use of roofing system.
- J. Electronic Leak Detection Testing (Standard Warranty) – The Waterproofing Installer shall arrange for testing through Waterproofing Manufacturer. See Section 3.11.

### 1.03 SUBMITTALS

- A. The Installer shall submit to the Owner's Representative and/or Design Professional the following:
1. A letter from Manufacturer certifying that the Installer is an approved Waterproofing Installer in good standing prior to the bid.
  2. Shop drawings and details that have been stamped and accepted by Waterproofing Manufacturer.
  3. Specimen copy of Waterproofing Manufacturer warranty.
  4. Specimen copy of warranty.
  5. Sample of Waterproofing membrane, grounding screen, thermal barrier, and cover board.
  6. Waterproofing Manufacturer's written inspection reports.
  7. Certificate of compliance of the system with Factory Mutual Construction Bulletin 1-29.
  8. Waterproofing Manufacturer's Qualifications as specified in 1.02.I.
  9. Material Safety Data Sheets (MSDSs) as required by General Specification S-018.
  10. Results of all electric leak detection testing.

### 1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Comply with General Specification S-018.
- B. All products delivered to the job site shall be in the original unopened containers or wrappings.
- C. Handle all materials to prevent damage. All materials shall be placed on pallets and fully protected from the elements with canvas tarpaulins.
- D. Membrane rolls shall be stored lying down on pallets and fully protected from moisture with canvas tarpaulins.

- E. Membrane, adhesives, and surface conditioner shall be stored at temperatures above 40 degrees F, or as per Manufacturer's recommendations.
- F. All flammable materials shall be stored in a cool dry area away from sparks and open flames. Follow precautions outlined on container or supplied by the material manufacturer/supplier.
- G. All material which the Owner's representative and/or Waterproofing Manufacturer determine to be damaged shall be removed from the job site and replaced at no cost to the Owner.

#### 1.05 JOB CONDITIONS

- A. Proceed with installation only after substrate preparation is complete. Owner's Representative and/or Design Professional and Installer must accept substrate before proceeding with membrane installation.
- B. Substrate must be clean, smooth and dry. Do not work in rain or snow or adverse weather conditions. Severe temperatures, moisture and humidity may affect the installation of products during construction. Comply with applicable installation requirements for all components. Ambient and substrate temperature must meet the minimum requirements as outlined in Manufacturer's published installation instructions.
- C. All work shall be scheduled and executed without exposing the completed waterproofing system and the building interior to the affects of inclement weather. The building and its contents shall be protected against all risks.
- D. The adequacy of the building to support the finished green roof has been verified by the Design Professional. The Installer is responsible for ensuring that the structure is not overloaded during installation.
- E. All new and temporary construction materials, including equipment and accessories, shall be secured in such a manner, at all times, as to preclude wind blow-off or damage.
- F. Liquid materials such as solvents and adhesives shall be stored and used away from open flames, sparks and excessive heat.
- G. The Installer shall take all necessary precautions when using adhesives or surface conditioner around building ventilation intakes and prevent volatile fumes or odors from entering the building ventilation system.



- H. The Installer shall verify that all drain lines are connected and un-blocked before starting work. Report all such blockages or non-connected drains to the Owner's representative and/or Design Professional in writing.
- I. The Installer is cautioned that PVC membranes are incompatible with asphalt, coal-tar, polystyrene, oil-based and plastic-based cements, creosote, penta-based materials, grease, fats, oils, and solvents. Such materials shall not come in contact with the waterproofing membrane at any time. If such contact occurs, the material shall be cut-out, discarded and patched.
- J. The adhered membrane flashing can be installed over existing residual asphalt-based waterproofing materials provided the material is fully cured, clean, sound and firmly bonded to the substrate (see Paragraph 3.02). Do not install self-adhered membrane over coal tar pitch.
- K. Arrange work sequence to avoid use of newly installed waterproofing for storage, walking surface, and equipment movement. Where such access is absolutely required, the Installer shall provide all necessary temporary protection and barriers to segregate the work area and to prevent damage to adjacent areas. Adequate protection of the membrane shall be provided for all waterproofing areas which receive traffic during construction. All damage which occurs to the waterproofing membrane and/or system shall be brought to the attention of the Owner's Representative and/or Design Professional and Waterproofing Manufacturer's Representative. All damage shall be repaired according to Waterproofing Manufacturer's recommendations. The party responsible for damage shall bear the cost of repairs.
- L. All demolished material removed for construction shall be immediately taken off the site to a legal dumping area authorized to receive such materials. Refer to Drawings for final disposition of removed ballast.
- M. If any unusual or concealed condition is discovered, stop work and notify the Owner's representative and/or design professional and Waterproofing Manufacturer's Representative immediately, in writing.
- N. Site cleanup, including both interior and exterior building areas in any way affected by the construction, shall be complete and to the Owner's satisfaction. All landscaped areas affected by construction activities shall be raked clean and seeded. All paved areas shall be swept clean. All areas stained, dirtied, discolored or otherwise damaged due to this work shall be cleaned, restored, or replaced as required to match the condition prior to the start of this work.

## 1.06 SEQUENCING OF THE WORK

- A. Do not proceed with installation of vegetative cover over the completed sections of the waterproofing without the acceptance of the Owner's Representative, Design Professional, and Waterproofing Manufacturer. A copy of the Final Inspection for Warranty is considered acceptance from Waterproofing Manufacturer.
- B. Protect the membrane and coordinate with other trades to avoid traffic over completed membrane surfaces.

## 1.07 BIDDING REQUIREMENTS

- A. Pre-Bid Meeting: Comply with P-003.
- B. Site Visit:
  - 1. Bidders shall visit the site and carefully examine the areas in question as to conditions that may affect proper execution of the work.
  - 2. All dimensions and quantities shall be determined or verified by the contractor.
  - 3. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions unless agreed to in advance with the Owner or Owner's Representative.

## 1.08 WARRANTIES

- A. General: A Waterproofing Manufacturer Representative's presence on a project regardless of reason, length, or frequency, does not imply that any additional coverage beyond that stated in the warranty is in effect.
- B. Installer's Warranty: The Installer shall supply the Owner with a minimum two-year workmanship warranty. The warranty obligation shall run directly to the Owner with a copy to Waterproofing Manufacturer.
- C. Waterproofing Manufacturer Warranty:
  - 1. Single-Source Warranty – Extensive Green Roofs (20 years). The Installer shall provide Waterproofing Manufacturer's Single-Source warranty to the Owner at the successful completion of the project.
  - 2. The Installer must be authorized and factory-trained by the Waterproofing Manufacturer prior to the project bid date and have authorization to perform installation of warranted waterproofing systems.
  - 3. The Waterproofing Manufacturer shall warrant to the Owner the vegetative cover and the repair of leaks in the waterproofing membrane resulting from defects in the membrane or workmanship for a period of 20 years. This warranty shall also guarantee 80% foliage

coverage so long as the Owner maintains a maintenance agreement approved by the Waterproofing Manufacturer and executed by a contractor accepted by the Waterproofing Manufacturer, for the duration of the warranty period. The warranty shall include provisions to repair or replace specified materials that have failed within the warranty period. System failures covered by the warranty shall include, in addition to leaks, the following:

- a. Failure of the vegetated cover system to support a robust ground cover
- b. Loss of soil permeability
- c. Development of anaerobic conditions in the profile
- d. Loss of drainage capacity
- e. Development of soil pathogens
- f. Deleterious changes in pH
- g. Slope related instability of the vegetated cover system
- h. Wind or water erosion of the vegetated cover system

## **PART 2 MATERIALS**

### **2.01 WATERPROOFING SYSTEM**

- A. Grounding Screen:
  1. Bright aluminum 18 x 16 screen mesh, supplied in 6 ft x 100 ft rolls packaged in a protective cardboard carton.
  2. Grounding screen shall be approved by the Waterproofing Manufacturer to be compatible with the waterproofing system.
  3. Grounding screen shall be installed per the roofing sections and details shown on the Drawings.
- B. Cover Board:
  1. Siliconized gypsum, fire-tested roof board with glass-mat facer.
  2. Thicknesses as noted on Project Drawings.
  3. Manufacturer:
    - a. DensDeck Prime, by Georgia-Pacific
    - b. Or approved equal.
- C. PVC Membrane:
  1. Provide self-adhered thermoplastic membrane with non-woven fiberglass reinforcing and lacquer coating.
  2. Membrane shall conform to ASTM D 4434 (latest version), "Standard for Polyvinyl Chloride Sheet Roofing". Classification: Type II, Grade I. Sarnafil G476-SA, 80 mil, thermoplastic membrane utilizing the spread coat process to include fiberglass reinforcement and lacquer coating.
  3. Waterproofing Manufacturer shall certify that the polymer thickness is of the polymer thickness specified. Certification is to be signed by the

Waterproofing Manufacturer's quality control manager. ASTM tolerance for membrane thickness is not accepted.

4. Membrane Properties:

<u>Parameters</u>	<u>ASTM Test Method</u>	<u>ASTM D-4434 Spec. Requirement</u>	<u>Typical Physical Properties</u>
Reinforcing Material	-	-	Fiberglass
Overall Thickness(1), min., inches (mm)	D638	0.045 (1.14)	[0.080 inches]
Thickness Above Scrim	-	-	0.023 (avg.)
Tensile Strength, min., psi (MPa)	D638	1500 (10.4)	1600 (11.1)
Elongation at Break, min. (machine / transverse)	D638	250% / 220%	250% / 220%
Seam strength(2), min. (% of tensile strength)	D638	75	80
Retention of Properties After Heat Aging	D3045	-	-
Tensile Strength, min., (% of original)	D638	90	95
Elongation, min., (% of original)	D638	90	90
Tearing Resistance, min., lbf (N)	D1004	10 (45.0)	14 (63.0)
Low Temperature Bend, -40° F (-40° C)	D2136	Pass	Pass
Accelerated Weathering Test (florescent light, uv exposure)	G154	5,000 Hours	10,000 Hours
Cracking (7x magnification)	-	None	None
Discoloration (by observation)	-	Negligible	Negligible
Crazing (7x magnification)	-	None	None
Linear Dimensional Change	D1204	0.10 % max.	0.02%
Weight Change After Immersion in Water	D570	± 3.0% max.	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass	Pass
Dynamic Puncture Resistance, 7.3 ft-lbf (10 J)	D5635	Pass	Pass
Initial Solar Reflectance	E903	-	0.83
Emissivity	E408, C1371, Other	-	0.90
Solar Reflective Index (SRI)	E1980	-	104
Recycled Content (5 & 10 ft. sheets only)	8 to 12% Pre-Consumer / Up to 1% Post Consumer.		

Notes:

- (1) Typical Physical Properties data is applicable for 0.048 in (1.2 mm) membrane thickness and greater.
- (2) Failure occurs through membrane rupture not seam failure.

5. Color of Membrane: Orange.

## 2.02 SYSTEM FLASHING PRODUCTS AND ACCESSORIES

### A. Flashing:

1. Protection Membrane:
  - a. 60 mil PVC membrane.
  - b. A fiberglass reinforced membrane adhered to approved substrate using approved adhesive. Consult Waterproofing Manufacturer's Product Data Sheets for adhesive options and additional information.
  - c. Manufacturer:
    - 1) G410-20 EnergySmart by Sarnafil.
    - 2) Or approved equal.
2. PVC clad metal flashing and coping:
  - a. A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. This shall be a minimum 24 gauge, G90 galvanized metal sheet with a 20 mil (0.5 mm) unsupported membrane laminated on one side. Consult Waterproofing Manufacturer's Product Data Sheet for additional information.

### B. Parapet Coping:

1. Systems shall be watertight and not require exposed fasteners or sealant
2. Joints: butt-type with concealed splice plates.
3. Performance:
  - a. Coping sections shall expand and contract freely while mechanically locked in place on anchor cleats.
  - b. Coping sections shall lock to anchor cleats by mechanical pressure from support chairs.
  - c. All coping cover joints shall be underlain with gutter/support chairs capable of draining water.
4. Coping Cap:
  - a. Length: 10'-0"
  - b. Width: As shown on the drawings. Field-verify and coordinate fabrication.
5. Coping Vertical Face and Back Leg: Field-verify and coordinate fabrication.
6. Internal Splice Plates: Concealed with finish matching coping cap.
7. Gutter/Support Chair: Metal gutter chair in color and finish to match coping cap.
8. Accessories: Corners, end caps, pier caps, etc shall be fabricated by the coping manufacturer.

## 2.03 ATTACHMENT COMPONENTS

### A. Fastening Components:

1. Fastening Plate: Used with various fasteners to attach cover board to roof deck. 3 inch square or round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating.
  2. Fasteners:
    - a. No. 12 corrosion-resistant fastener used with fastening plates to attach insulation boards to steel or wood roof decks. Shall have modified buttress thread, a minimum shank diameter of 0.168 inch and a thread diameter of approximately 0.214 inch.
    - b. A drive-pin expansion type fastener for attachment of membrane, flashing, termination bars, and expansion joints to concrete, masonry, and brick with zinc sheaths and stainless steel pins.
    - c. A threaded fastener with a rubber gasket used with termination bar to terminate flashings into masonry substrates such as concrete and concrete block.
  3. Termination Bar:
    - a. An extruded aluminum, flat low profile bar used to terminate flashing membrane.
- B. Accessories:
1. Aluminum tape: A pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and as a bond-breaker.
  2. Hot-air welder: 220 volt, self-propelled, hot-air welding machine used to seal long lengths of Sarnafil membrane seams.
  3. Solvent: Solvent cleaner, approved by Waterproofing Manufacturer, for general cleaning of residual asphalt, scuff marks, etc., from the membrane surface.
  4. Sealant used at flashing terminations.
  5. Reglet: A heavy duty, surface mounted aluminum flashing termination reglet used at walls.

## 2.04 RELATED MATERIALS

- A. Wood Nailer:
1. Wood nailers shall be treated for fire and rot resistance (ACQ treated) and be No. 2 quality or better lumber.
  2. Creosote or asphalt-treated wood is not acceptable.
  3. Wood nailers shall conform to Factory Mutual Loss Prevention Data Sheet 1-49.
  4. All wood shall have a maximum moisture content of 19% by weight on a dry-weight basis.

- B. Plywood:
  - 1. When adhering the flashing membrane directly to plywood, a minimum 1/2 inch (13 mm) CDX (C side out), smooth-surfaced exterior grade plywood with exterior grade glue shall be used.
  - 2. Rough-surfaced plywood or high fastener heads will require the use of felt behind the flashing membrane.
  - 3. Plywood shall have a maximum moisture content of 19% by weight on a dry weight basis.
  
- C. Miscellaneous Fasteners and Anchors:
  - 1. Fasteners are to be compatible with materials in contact with fasteners.
  - 2. All fasteners and anchors shall have a minimum embedment of 1-1/4 inches and shall be approved for such use by the fastener manufacturer.
  - 3. Fasteners for attachment of metal to wood blocking shall be annular ring nails.
  - 4. Fasteners for attachment of metal to masonry shall be all-metal expansion type fasteners.
  - 5. All fasteners shall meet Factory Mutual Standard 4470 for corrosion resistance.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine all surfaces scheduled to receive waterproofing membrane and flashing for roughness, contaminants, unsound structural substrates or other conditions that may impair the waterproofing application. Notify the owner and copy Waterproofing Manufacturer in writing of all such conditions. Do not commence work until all defects are remedied.
  
- B. Installer shall be responsible for acceptance or provision of proper substrate to receive new waterproofing materials.
  
- C. Installer shall verify that the work done under related sections meets the following conditions:
  - 1. Roof drains and/or scuppers have been reconditioned and/or replaced and installed properly.
  - 2. Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new waterproofing materials.
  - 3. All surfaces are smooth and free of dirt, debris and incompatible materials.

### 3.02 SUBSTRATE PREPARATION

- A. Green Roof Waterproofing over existing roofing substrate:
  - 1. General Criteria:
    - a. Remove all gravel ballast and dispose offsite.
    - b. Remove EPDM roofing membrane and dispose offsite
    - c. Inspect insulation and replace and wet or degraded insulation
    - d. Grounding screen shall be installed directly over insulation and attached to structure with fasteners and plates.
    - e. Adhere 1/4-inch cover board
    - f. Install Waterproofing Membrane. Membrane shall be adhered to cover board complete with all flashings. Perimeter edge shall be removed and reinstalled to allow for proper flashing of Green Roof waterproofing system.
    - g. All bituminous or coal tar pitch residue must be completely removed.
  - 2. Deck:
    - a. All deteriorated decking shall be brought to the attention of the Owner's Representative to determine method of treatment or replacement.

### 3.03 WOOD NAILER INSTALLATION (where required)

- A. Install continuous wood nailers at the perimeter of the entire area and around projections and penetrations as shown on the Drawings. Thickness shall be as required to match substrate and/or insulation height to allow a smooth transition.
- B. Nailers shall be anchored to resist a minimum force of 300 pounds per linear foot in any direction. Individual nailer lengths shall not be less than 3 feet long. Nailer fastener spacing shall be at 12 inches on-center or 16 inches on-center if necessary to match the structural framing. Fasteners shall be staggered 1/3 the nailer width and installed within 6 inches of each end. Two fasteners shall be installed at ends of nailer lengths. Nailer attachment shall also meet the requirements of the current Factory Mutual Loss Prevention Data Sheet 1-49.
- C. Stainless steel, corrosion resistant, fasteners are required when mechanically attaching any product to wood nailers and wood products treated with ACQ (Alkaline copper Quaternary). When ACQ treated wood is used on steel roof decks or with metal edge detailing, a separation layer must be placed between the metal and ACQ treated wood.

### 3.04 GROUNDING SCREEN AND COVER BOARD INSTALLATION



- A. Grounding Screen Installation:
  - 1. Lay the grounding screen over insulation.
  - 2. Overlap adjacent grounding screen edges a minimum of 3 inches. Positive contact between adjacent sheets is required at both side and end laps. Adjacent sheets may be taped together using duct or aluminum tape to prevent shifting.
  - 3. Connect the grounding screen to a conductive part of the structure at several separate locations – examples: metal deck or metal curb, metal vent stack, etc. Use 2 inch wide strip of the grounding layer extended from the grounding layer to the structure, and tape it into place. Extend 2 inch strips behind wall flashing and under counterflashing periodically for future connection as described in Waterproofing Manufacturer grounding screen installation instructions.

### 3.05 ADHERE COVER BOARD

### 3.06 ADHERED THERMOPLASTIC WATERPROOFING MEMBRANE INSTALLATION

- A. Comply with Waterproofing Manufacturer's most current quality assurance requirements, installation instructions, specific recommendations, and approved shop drawings for this project.
- B. All surfaces shall be dry and free of dirt, dust, and debris.
- C. Apply adhered PVC waterproofing membrane only in dry weather, and when the membrane, air, and substrate temperature is a minimum of 25 degrees F and a minimum 40 degrees F over unprimed cover boards.
- D. Workers and all others that walk on the waterproofing shall wear clean, soft-soled shoes so as not to damage materials. Heed all Manufacturer's cautions and warnings in regard to product use. Membrane is slippery when wet or covered with frost, snow, and ice. Take proper precautions.
- E. Lay out work to minimize traffic over installed areas.

### 3.07 HOT-AIR WELDING OF LAP AREAS

- A. General:
  - 1. All surfaces to be welded shall be clean and dry. No contaminants shall be present within lap areas.
  - 2. Adjacent sheets shall be hot-air welded in accordance with Waterproofing Manufacturer's instructions. All seams shall be hot air welded. Lap area shall be a minimum of 2-1/2 inch wide. Overlaps shall be with the flow of water where possible.

3. Patch all 3-way membrane overlaps (T joints) with a minimum 60 mil thick, 4 inch round or square patch.
  4. Welding equipment shall be provided by or approved by Waterproofing Manufacturer's.
- B. Machine Welding:
1. Machine welded seams are achieved by the use of automatic welding equipment. When using this equipment, Waterproofing Manufacturer's instructions must be followed and local codes for electric supply, grounding and over current protection observed. A dedicated portable generator (30 A, 220 V, and recommended min. 7,500 Watts) is required. No other equipment shall be operated off the generator.
- C. Quality Control of Welded Seams:
1. All completed welded seams shall be checked by the Waterproofing Installer after cooling for continuity using a rounded screwdriver or other suitable blunt object.
  2. On-site evaluation of welded seams shall be made daily by the Waterproofing Installer.
  3. Cross-section samples shall be taken a minimum of three times a day through completed seams and evaluated immediately.
  4. Each test cut shall be patched by the Waterproofing Installer.

### 3.08 MEMBRANE FLASHINGS

- A. All flashings shall be installed concurrently with the waterproofing membrane according to Waterproofing Manufacturer approved details as the job progresses. Flashings shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. All masonry joints shall be struck flush. Rough or incompatible surfaces may be covered with minimum 1/2 inch (13 mm) CDX plywood. (Do not apply surface conditioner to plywood flashing substrates). Flashing may be self-adhered waterproofing membrane or waterproofing membrane with field-applied adhesive installed according to Waterproofing Manufacturer's printed instructions.
- B. When adhering to vertical surfaces greater than 30 inches in height, provide intermediate fastening of the flashing membrane according to Waterproofing Manufacturer's requirements.
- C. Complete the entire waterproofing assembly and flashing in a single working day; avoid exposure of any components to rain, snow, or dew. If rain threatens during the day, or in an emergency, protect the unfinished exposed waterproofing and flashing components. Waterproofing Installer is solely responsible for complete water-tightness of the roof during the course of the work.

- D. All flashing membranes shall be mechanically fastened along the top edge according to approved Waterproofing Manufacturer details. Acceptable fasteners shall be used to secure flashings to substrate. Seal top of termination with an acceptable sealant.
- E. All flashings shall extend a minimum of 8 inches above the overburden (green roof media) unless previously accepted by the Owner's representative and/or Engineer and Waterproofing Manufacturer, in writing.
- F. A minimum 8 inch wide cover strip shall be used where self-adhered flashing membranes meet at end laps, butt joints, and all non-selvedge edges. Butt adjoining sheets closely, center the cover strip over both membranes and hot-air weld. Complete inside and outside corner flashing details with prefabricated corner patches
- G. No bituminous residue shall be in contact with the underside of the membrane flashing, unless self-adhered membrane or asphalt resistant membrane is used. Flashing substrates contaminated with coal-tar shall be completely cleaned, or overlaid with minimum 1/2 inch thick CDX plywood or minimum 24 gauge stainless steel sheet metal.

### 3.09 PVC CLAD METAL FLASHINGS

- A. Complete all metal work in conjunction with waterproofing and flashings so that a watertight condition exists daily.
- B. Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.
- C. Metal joints shall be watertight.
- D. Metal flashings shall have a 4 inch minimum nailing flange and shall be fastened into solid wood blocking 4 inches on center staggered, or into concrete with acceptable concrete anchors 6 inches on center staggered. Fasteners shall penetrate the wood nailer a minimum of 1-1/4 inch or into concrete a minimum of 1 inch.
- E. Adjacent sheets of PVC clad metal shall be spaced 1/4 inch apart. The end joints of the metal shall be fastened 6 inches on center. The joints shall be covered with 2 inch wide aluminum tape. A 4 inch wide membrane flashing strip shall be hot air welded over the joint.

3.10 TEMPORARY CUT-OFF

- A. All flashings shall be installed concurrently with the membrane in order to maintain a watertight condition as the work progresses. Provide temporary cut-offs around exposed edges and at incomplete flashing areas from the new membrane to the structural deck or existing waterproofing. Remove the cut-offs completely before proceeding with subsequent work.
- B. If inclement weather occurs while a temporary cut-off is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

3.11 ELECTRIC LEAK DETECTION TESTING

- A. Provide electric leak detection testing over the completed waterproofing membrane for testing of capillary defects and/or breaches in the membrane prior to the installation of subsequent layers.
- B. Should leaks be discovered, the Waterproofing Installer shall locate leak source(s) and make repairs. Re-test to assure watertightness. All costs associated with the repairs shall be borne by the Waterproofing Installer.
- C. Testing shall be conducted at end of installation and prior to vegetated roof cover assembly.

**END OF SECTION**