



SECTION 07555

COAL TAR ELASTOMERIC MEMBRANE WATERPROOFING
AND VEGETATED ROOF ASSEMBLY

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This specification is based on Hyload Roofing Systems; HyGro Coal Tar Elastomeric Membrane Waterproofing and Vegetated Roof assembly products, located at:

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Hyload Inc. is a U.S. company with its corporate office in Seville, Ohio, and its manufacturing facility located in Wadsworth, Ohio.

Hyload, is part of IKO, a family business operating for more than 60 years providing global manufacturing and supply of quality roofing products including shingles, commercial roofing and asphaltic bituminous waterproofing products.

For the roofing and waterproofing markets, Hyload offers the unique benefit of including coal tar pitch as a key component in our Elvaloy® membranes. These Coal Tar Elastomeric Membranes (CTEM) combine the time-tested benefits of coal tar with today's technological advancements. Our roofing line also offers a white membrane to meet the need for reflective roof assemblies, while our masonry flashing membranes offer additional color choices.

Hyload Elvaloy® membranes are represented by sales specialist firms in territories throughout the United States. Hundreds of millions of square feet of membrane have been installed since production began in the U.S. in 1982. Our technical service department and customer service personnel stand ready to serve our customers.

Follow the instructions listed in the SPECIFIER INSTRUCTIONS included throughout the specification. Edit carefully to suit project requirements. Modify as necessary and delete paragraphs that are not applicable. Note that the SPECIFIER INSTRUCTIONS are included as "Hidden Text" in MS-Word. Display hidden notes to specifier by using "Tools"/"Options"/"View"/"Hidden Text".

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hyload HyGro Coal Tar Elastomeric Membrane Waterproofing and Vegetated Roof assembly single-source, coal tar elastomeric (CTEM) protected membrane waterproofing, vegetated green roof and plaza deck assembly.

1.2 RELATED SECTIONS

- A. Section 02810 - Irrigation System.
- B. Section 03300 – Cast-in-Place Concrete.
- C. Section 05300 - Metal Roof Deck.
- D. Section 06100 - Rough Carpentry.
- E. Section 06114 - Wood Blocking and Curbing: Wood nailers and cant strips.
- F. Section 07220 - Insulation Board: Insulation and fastening.
- G. Section 07620 - Sheet Metal Flashing and Trim: Weather protection for base flashings.
- H. Section 07710 - Manufactured Roof Specialties: Counter flashing gravel stops, and fascia.
- I. Section 07724 - Roof Hatches: Frame and integral curb; Counter flashing.
- J. Section 08620 - Unit Skylights: Skylight frame and integral curb and counter flashing.
- K. Section 08630 - Metal-Framed Skylights: Skylight frame and integral curb and counter flashing.
- L. Section 15120 - Piping Specialties: Roof Drains, Sumps.
- M. Section 15145 - Plumbing for irrigation.

1.3 REFERENCES

- A. ASTM C 272 - Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
- B. ASTM C 578 - Specification for Preformed, Cellular Polystyrene Thermal Insulation
- C. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
- D. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
- E. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- F. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
- G. ASTM D 1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

- H. ASTM D 1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
- I. ASTM D 1621 - Test for Compressive Properties of Rigid Cellular Plastics
- J. ASTM D 2136 - Standard Test Method for Coated Fabrics—Low-Temperature Bend Test.
- K. ASTM D 3045 - Standard Practice for Heat Aging of Plastics Without Load
- L. ASTM D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
- M. ASTM D 4491 - Test Methods for Water Permeability of Geotextiles by Permittivity
- N. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- O. ASTM D 4716 - Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
- P. ASTM D 4833 - Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
- Q. ASTM E 96 - Tests for Water Vapor Transmission of Materials in Sheet Form
- R. AASHTO M 288 - Standard Specification for Geotextile Specification for Highway Applications
- S. Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.
- T. Warnock Hersey (WH): Fire Hazard Classifications.
- U. ASCE 7-05, Minimum Design Loads for Buildings and Other Structures
- V. UL - Fire Resistance Directory.
- W. FM Approvals - Roof Coverings.
- X. German FFL Greenroof Guidelines - Guideline for the Planning, Execution and Upkeep of Green Roof Sites, Release 2002. Worldwide acknowledged state-of-the-art technology as scientific foundation for successful and thriving green roofs.

1.4 SYSTEM DESCRIPTION

- A. Single-ply, CTEM waterproofing system that prevents the passage of liquid water under vegetated roof and plaza deck and complies with physical requirements demonstrated by testing performed by an independent testing agency of manufacturer's current waterproofing formulations and system design.
 - 1. Single-ply application of self-adhered waterproofing membrane sheet bonded together with hot air welds or structural sealant.
 - 2. System designed to limit lateral movement of water in event of membrane damage without use of additional installed components.
 - 3. Membrane highly resistant to acids, bases, oils, greases, petroleum products, root penetration, and organic growth such as molds and algae. Membranes are UV stable, impervious to standing water, and not effected by contact with asphalt or coal tar.

4. Membranes shall have successfully passed the German FLL test protocol for “Investigating resistance to root penetration at green-roof sites” (FLL, 2002) at an independent accredited testing laboratory.
- B. Two-ply, CTEM waterproofing system that prevents the passage of liquid water under vegetated roof and plaza deck and complies with physical requirements demonstrated by testing performed by an independent testing agency of manufacturer’s current waterproofing formulations and system design.
1. Two-ply application of self-adhered waterproofing membrane sheets bonded together with hot air welds or structural sealant.
 2. System designed to limit lateral movement of water in event of membrane damage without use of additional installed components.
 3. Base and cap membranes resistant to acids, bases, oils, greases, petroleum products, organic growth such as molds and algae, and root penetration. Membranes shall be UV stable, impervious to standing water, and not effected by contact with asphalt or coal tar.
 4. Membranes shall have successfully passed the German FLL test protocol for “Investigating resistance to root penetration at green-roof sites” (FLL, 2002) at an independent accredited testing laboratory.
- C. Vegetated Roofing Assembly:
1. Protective drainage panels installed over waterproofing membrane.
 2. Drainage system.
 3. Standard growing media.
 4. Pre-planted, vegetative blankets and plugs with integral drainage/filter fabric and manufacturer’s standard growth medium.
 5. Plants: Drought-resistant mix of grasses, perennials and groundcovers suitable to a non-or minimally-irrigated installation.
 6. Roof pavers and paver pedestals
 7. Stone ballast

1.5 DESIGN REQUIREMENTS

- A. Perform work in accordance with all federal, state and local codes.
- B. Exterior Fire Test Exposure: Exposed waterproofing system shall achieve a UL, FM or WH Class rating for roof slopes indicated on the Drawings as follows:
1. Factory Mutual Class A Rating.
 2. Underwriters Laboratory Class A Rating.
 3. Warnock Hersey Class A Rating.
- C. LEED: Roof waterproofing system shall meet the reflectivity and emissivity criteria to qualify for one point under the LEED credit category, Credit 7.2, Landscape & Exterior Design to Reduce Heat Island - Roof.
- D. Roof Waterproofing System membranes containing recycled or bio-based materials shall be third party certified through UL Environment.

1.6 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data:
1. Waterproofing: Manufacturer's data sheets on each product to be used, including:

- a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Application procedures.
 - 2. Vegetation: Manufacturer's data sheets on each product to be used, including:
 - a. Drainage panel root barrier.
 - b. Vegetated roofing system, components, growing media type, and planting types with descriptive published data indicating characteristics and limitations.
 - c. Include standard details, system components, and proposals for plant types and characteristics.
 - d. Include manufacturer's installation instructions, special procedures, and conditions requiring special attention.
 - e. Storage and handling requirements and recommendations.
- C. Shop Drawings
- 1. Waterproofing:
 - a. Submit shop drawings showing general layout, seaming, anchoring sizes and types, membrane thickness, and other similar detailed information necessary to fully describe application.
 - b. Include:
 - 1) Location of penetrations
 - 2) Perimeter and penetration details
 - 3) Sheet layout and size
 - 4) Number of flashing rolls by width
 - c. Show adjacent or related portions of Work in a complete manner.
 - d. Coordinate submittal with submittals of related portions of Work:
 - 2. Shop Drawings Vegetated Roof:
 - a. Submit shop drawings showing plan layout and details at critical terminations of garden roof system with adjacent building construction. Include flashing connections to planter system, pavers, and building systems.
- D. Verification Samples: For each product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product.
- E. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
- 1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
 - 2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals:
- 1. Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
 - 2. Manufacturer's instructions for Owner maintenance of planting media as needed for long term propagation and health of vegetation. Include special provisions as applicable for specific plant media and climatic zone.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of sheet membrane roofing and waterproofing systems with not less than 10 years documented experience.

- B. Installer Qualifications: Provide a letter of certification from membrane manufacturer that installer firm utilized for application of sheet membrane waterproofing system is an approved installer in good standing.
1. Submit listing of not less than 5 of installer's most recent applications representing similar scope and complexity to Project requirements. List shall include information as follows:
 - a. Project name and address
 - b. Name of owner
 - c. Name of contractor
 - d. Name of architect
 - e. Date of completion
 2. Provide manufacturer's certification that products to be used comply with specified requirements and are suitable for intended application.
 3. Prior to flood testing, provide certification from structural engineer that structure will withstand dead load of water.
- C. Single-Source Responsibility: Obtain waterproofing and vegetative roof assembly components and materials from a single manufacturer regularly engaged in the manufacturing and supply of the specified products.
- D. Pre-Installation Conference:
1. Schedule a conference to be held on-site in advance of ordering materials and beginning application of roofing, but in no case less than 30 days before application of roofing. Provide not less than 72 hours advance notification to attendees, Owner, and Architect.
 2. Conference attendees shall include Owner, Architect, Contractor, roofing installer, a representative of roofing system manufacturer, and representatives of other trades whose work may interface with or affect roof system application.
 3. Topics to be discussed at conference shall include:
 - a. A review of Contract Documents and accepted shop drawings shall be made. If conflicts exist between roofing system manufacturer's specifications and Contract Documents, these differences shall be defined and resolved. Consult roofing manufacturer's representative to assist in resolving issues.
 - b. Establish trade-related work schedules and appropriate trade sequencing, including timely installation of equipment and penetrations to protect and limit traffic on membrane roofing.
 - c. Review protection course, drainage layer, filter layer, water retention layer, growing, media, plant materials and other requirements required by roofing manufacturer.
 - d. Verify water source and connections for irrigation system. Verify placement of automated irrigation system and controls.
 - e. Construction schedules and work methods shall be reviewed to prevent damage to roofing, including provisions for installation of temporary traffic paths or walkways for protection of finished roofing system.
 - f. Weather conditions and working temperature criteria shall be reviewed.
 4. Pre-construction conference and inspection shall serve to clarify Contract Documents, application requirements and what work shall be completed before application can begin.
 - a. If roofing applicator or representative of roof system manufacturer discovers problems during inspection of substrates, a second pre-application shall be held to verify that corrective measures have been taken.
 5. Following Waterproofing Membrane Testing and acceptance and prior to installation of vegetative roof system and plantings, meet at site with installer and Owner's maintenance personnel to review procedures and Owner expectation.

6. Prepare and submit to parties in attendance, Architect, and Owner's a written report of each pre-installation conference. Reports shall be submitted within 3 days following conference.
- E. Manufacturer's Field Service:
1. Provide the services of a competent field representative on-site to accept substrate surface before application of waterproofing materials and to provide on-site technical assistance and application guidance for application of waterproofing system.
 2. Conduct Electronic Field Mapping (EFM) tests specified herein under Field Quality Control to verify weather and waterproof and weather tight condition of waterproofing system prior to start of vegetative roof system and plantings operations.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver prepackaged materials in manufacturer's original unopened packaging with labels intact. Packaging or containers shall fully identify brand, type, grade, class, and other qualifying information used to describe contents.
- B. Storage: Take measures to locate and spread loads in manner to not exceed load bearing capacity of roof deck.
1. Roofing materials that are susceptible to retaining moisture or that may be damaged by moisture shall be stored in a dry location before application. Moisture-sensitive materials shall be stored in enclosed areas protected from moisture or elevated humidity.
 - a. Store membrane rolls lying down.
 - b. Stack materials on pallets or platforms that are raised off ground or substrate.
 - c. Cover materials in a manner to provide air circulation and to prevent damage to surfaces.
 - d. Store sealants, adhesives, and mastics at temperatures above 40 degrees F.
 - e. Store flammable materials in a cool dry area away from sparks and open flames. Follow precautions outlined on container or supplied by material manufacturer/supplier.
 - f. Materials determined by Architect, and/or manufacturer's field representative to be damaged shall be removed from site and replaced at no cost to Owner.
 2. Store vegetated planters and materials over plywood panels or protective sheeting and do not allow products, growing media, grit, debris, and pedestrian traffic on unprotected roofing membrane.
 - a. Maintain health of plant media as recommended by nursery guidelines prior to rooftop installation.
 - b. Provide water source for irrigation of and maintenance of plants until permanent irrigation system is in place.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 COORDINATION

- A. Coordinate Work of this section with associated roof mounted equipment, roof penetrations and related metal flashings as work of this section proceeds.

1.10 SEQUENCING

- A. Apply roofing system in a timely manner, including installation of protection layer(s), drainage panels, and insulation in conjunction with work of other trades. Coordinate with other trades to

avoid traffic over completed membrane surfaces. Coordinate with installation of drains as shown on Drawings, including flashing, and associated waterproofing work.

- B. Water tests of completed sections of waterproofing membrane shall be successfully completed before proceeding with protection layers and overburden. Schedule water tests promptly to allow timely installation of protection layers.

1.11 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
 - 1. Waterproofing materials and components shall not be applied unless correct solvent, adhesive, heat welding, or application temperature can be maintained. If proper application temperatures cannot be maintained, application shall cease.
 - 2. Do not apply waterproofing if precipitation of any kind is occurring or is imminent. Materials shall not be applied if liquid moisture, snow, or ice is present on substrate.
- B. Ambient Air Temperature: Install plant materials preferably between April 1 and November 1 (at northern latitudes) at temperatures between 40 and 95 degrees F, except as otherwise instructed by manufacture. Do not install if extended freezing temperatures are expected or if ambient growing media temperature is expected to remain below 50 degrees F.

1.12 WARRANTY

- A. Roofing System Manufacturer's Single-Ply Warranty:
 - 1. Provide a manufacturer's membrane only. Warranty shall be limited to performance of roofing membrane for a period of 10 years from Date of Substantial Completion.
 - 2. Provide a manufacturer's membrane only. Warranty shall be limited to performance of roofing membrane for a period of 15 years from Date of Substantial Completion.
 - 3. Provide a manufacturer's labor and material. Warranty shall include repair of leaks in roofing membrane resulting from defects in membrane or workmanship for a period of 10 years from Date of Substantial Completion.
 - 4. Provide a manufacturer's labor and material. Warranty shall include repair of leaks in roofing membrane resulting from defects in membrane or workmanship for a period of 15 years from Date of Substantial Completion.
- B. Roofing System Manufacturer's Two-Ply Warranty:
 - 1. Provide a manufacturer's membrane only. Warranty shall be limited to performance of roofing membrane for a period of 20 years from Date of Substantial Completion.
 - 2. Provide a manufacturer's labor and material. Warranty shall include repair of leaks in roofing membrane resulting from defects in membrane or workmanship for a period of 20 years from Date of Substantial Completion.
- C. Contractor's Warranty:
 - 1. Provide a workmanship warranty for not less than two-years commencing from Date of Substantial Completion.
 - 2. Work related to roofing membrane, flashing, or metal work found to be defective or not in compliance with contract documents shall be removed and replaced at no cost to Owner. Obligation of warranty shall run directly to Owner with a copy to membrane manufacturer.
- D. Vegetation Warranty:

1. Provide a 2 year vegetation thrive coverage warranty of a minimum 50 percent thrive coverage at the end of the first year and minimum 80 percent thrive coverage at the end of the second year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Hyload Roofing Systems; 5020 Enterprise Pkwy., Seville, OH 44273. ASD. Phone Toll Free: 800-457-4056. Phone: 330-769-3546. Fax: 330-769-4153. Web: www.hyload.com. Email: _____.
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SINGLE PLY ROOFING SYSTEM

- A. Membrane: Self adhered, Hyload Hyproof SA fully adhered Elvaloy modified coal tar elastomeric sheet. Bottom of sheet coated with 15 mils of SBS-modified asphalt with a dry seldge edge for hot air welds. Membrane will not support biological growth such as molds or algae, nor will it allow root penetration.
 1. Thickness:
 - a. SA 75: 60 mils membrane/15 mils adhesive/75 mils total.
 - b. SA 90: 75 mils membrane/15 mils adhesive/90 mils total.
 2. Properties:
 - a. Tensile Strength: ASTM D 638; 1050 psi minimum
 - b. Elongation at Break: ASTM D 638; 150 percent minimum
 - c. Seam Strength (minimum percent of tensile strength): ASTM D 638; 95 percent.
 - d. Retention of Properties after Heat Aging: ASTM D 3045
 - e. Tensile Strength (minimum percent of original): ASTM D 638; 95 percent.
 - f. Elongation (minimum percent of original): ASTM D 638; 90 percent.
 - g. Tear Resistance: ASTM D 1004; 250 lb/in minimum.
 - h. Low Temperature bend (-40°F): ASTM D 2136; Pass.
 - i. Linear Dimensional Change: ASTM D 1204; 9.0 percent maximum.
 - j. Weight Change after Immersion in Water: ASTM D 570; 2.8 percent maximum.
 - k. Water Vapor Permeance: ASTM E 96; 0.375 perms maximum.
 - l. Puncture Resistance: Federal Method 2065; 50.0 pounds, minimum.
- B. Membrane Flashing: Hyload Elvaloy Preformed Shapes modified coal tar elastomeric sheet
 1. Thickness: Not less than 60 mils.
 2. Sheet Width: 4 inches, 6 inches, 9 inches, and/or 12 inches as needed.
- C. Preformed Three Dimensional Shapes: Hyload - Cloaks
 1. Shapes: As needed to meet Project requirements including, but not limited to detail corners, level changes, stop ends, and other similar special applications.
- D. Insulation Board: Extruded polystyrene; ASTM C 578, Type VII:
 1. Thickness: As indicated on Drawings.
 2. Thermal Resistance:
 - a. 1-1/2 inch - R 7.5
 - b. 2 inch - R 10
 - c. 2-1/2 inch - R 12.5

- d. 3 inch - R 15
 - e. 3-1/2 inch - R 17.5
 - f. 4 inch - R 20
3. Properties:
- a. Compressive Strength; ASTM D 1621: 60 psi minimum.
 - b. Water Absorption; ASTM C 272: 0.1 percent by volume maximum.
 - c. Water Vapor Permeance; ASTM E 96: 1.0 perm for 1 inch maximum.

2.3 TWO PLY WATERPROOFING SYSTEM

- A. Base Ply Membrane: Self adhered, Hyload Hyproof SA fully adhered Elvaloy modified coal tar elastomeric sheet. Bottom of sheet coated with 15 mils of SBS-modified asphalt with a dry selvedge edge for hot air welds. Membrane will not support biological growth such as molds or algae, nor will it allow root penetration.
- 1. Thickness:
 - a. SA 75: 60 mils membrane/15 mils adhesive/75 mils total.
 - b. SA 90: 75 mils membrane/15 mils adhesive/90 mils total.
 - 2. Properties:
 - a. Tensile Strength: ASTM D 638; 1050 psi minimum
 - b. Elongation at Break: ASTM D 638; 150 percent minimum
 - c. Seam Strength (minimum percent of tensile strength): ASTM D 638; 95 percent.
 - d. Retention of Properties after Heat Aging: ASTM D 3045
 - e. Tensile Strength (minimum percent of original): ASTM D 638; 95 percent.
 - f. Elongation (minimum percent of original): ASTM D 638; 90 percent.
 - g. Tear Resistance: ASTM D 1004; 250 lb/in minimum.
 - h. Low Temperature bend (-40°F): ASTM D 2136; Pass.
 - i. Linear Dimensional Change: ASTM D 1204; 9.0 percent maximum.
 - j. Weight Change after Immersion in Water: ASTM D 570; 2.8 percent maximum.
 - k. Water Vapor Permeance: ASTM E 96; 0.375 perms maximum.
 - l. Puncture Resistance: Federal Method 2065; 50.0 pounds, minimum.
- B. Self Adhering Elastomeric Membrane (SAM): Hybase SAM, self-adhering elastomeric sheet membrane (SAM) blends DuPont Elvaloy KEE (ketone ethylene ester) with coal tar pitch with dispersed polyester fibers.. Membrane is compounded, calendered to thickness, and in a separate manufacturing process the adhesive, release paper, and lay lines are added.
- 1. Overall Thickness:
 - a. SAM 50: 35 mils membrane/15 mils adhesive/50 mils total.
 - b. SAM 60: 45 mils membrane/15 mils adhesive/60 mils total.
 - 2. Physical Properties:
 - a. Tensile Strength: ASTM D 412, 1500 lbs/in²
 - b. Elongation: ASTM D 412, 170%
 - c. Tear Strength: ASTM D 624, 300 ppi
 - d. Density @ 70%: 80 lbs/ft²
 - e. Low Temperature Flexibility: 37-GP-56M, Pass
 - f. Water Absorption: 37-GP-56M, Less than 0.1%
 - 3. Approvals: Meets the requirements of Underwriters Laboratories for a Class A fire rating in various system configurations and Factory Mutual Class 1-90 in various system configurations.
- C. Preformed Three Dimensional Shapes: Hyload - Cloaks
- 1. Shapes: As needed to meet Project requirements including, but not limited to detail corners, level changes, stop ends, and other similar special applications.
- D. Membrane Flashing: Hyload SA modified coal tar elastomeric sheet

1. Thickness: Not less than 60 mils.
 2. Sheet Width: 9 inches, and/or 12 inches as needed.
- E. Sealing Strips: Hyproof GL sealing strip.
1. Thickness: Not less than 60 mils.
 2. Sheet Width: 4 inches, 6 inches as needed.
- F. Insulation Board: Extruded polystyrene; ASTM C 578, Type VII:
1. Thickness: As indicated on Drawings.
 2. Thermal Resistance:
 - a. 1-1/2 inch - R 7.5
 - b. 2 inch - R 10
 - c. 2-1/2 inch - R 12.5
 - d. 3 inch - R 15
 - e. 3-1/2 inch - R 17.5
 - f. 4 inch - R 20
 3. Properties:
 - a. Compressive Strength; ASTM D 1621: 60 psi minimum.
 - b. Water Absorption; ASTM C 272: 0.1 percent by volume maximum.
 - c. Water Vapor Permeance; ASTM E 96: 1.0 perm for 1 inch maximum.

2.4 ACCESSORIES

- A. Primer: Hyload Hyprime Primer is an acrylic polymer and highly refined asphalt primer with exceptional UV resistance, flexibility, and adhesiveness. Contains no VOC's.
- B. Sealant: Hyload Structural Sealant moisture cure, moisture insensitive, high performance polyether sealant.
- C. Adhesive: Hyload Membrane Adhesive moisture cure, moisture insensitive, high performance polyether adhesive.
- D. Adhesive Mastic: Hyload Trowel-On Membrane (TOM) waterproofing mastic that can be applied in beads from a 28 oz caulking tube or trowel-applied from 2 or 5 gallon pails.
- E. Reinforcing Strip: Manufacturer's recommended polypropylene and polyester fabric.
- F. Metal Termination Bars: Extruded aluminum pre-punched at 6 inches on center; 1 inch wide by 1/8 inch thick.
- G. Concrete Preparation Materials:
1. Bonding Bridge. Bonding Agent: Sika - Sikadur 32, Hi-Mod.
 2. Polymer Modified Patching Mortar:
 - a. Horizontal Application Product: Sika - SikaTop 122.
 - b. Vertical and Over Head Application Product: Sika - SikaTop 123.
 3. Crack Filler: Sika - SikaTop 111.
- H. Roof Pavers: Precast concrete, 2 feet (0.6 m) wide by 2 feet (0.6 m) feet long by 2 inches (50.8 mm), thick, 18 pounds per square foot (8.82 kg per sq. m) minimum, and compressive strength of 6500 pounds per square inch (49 Mpa) minimum.
- I. Paver Pedestals: Rubber pedestals to elevate the pavers above the surface of the roof membrane and promote positive drainage.

- J. Stone Ballast: No.4 size, 1-1/2 inch (38.1 mm) nominal diameter, rounded, water-worn gravel conforming to ASTM D448 and applied at a minimum of 10 pounds per square foot (0.48 kPa).

2.5 MOLDED-SHEET DRAINAGE PANEL

- A. Three-dimensional, two-part prefabricated soil sheet drain: Hyload HyGro DB 50:
 - 1. Core: High Impact Polystyrene (HIPS)
 - a. Thickness: 0.44 inch nominal (11 mm)
 - b. Compressive Strength: 15,000 lbs/ft² (718 kPa); ASTM D 1621
 - c. In-Plane Flow Rate: 16 GPM per foot of width; ASTM D 4716
 - d. Water Storage Capacity: 0.06 GPM per foot
 - e. Perforation Open Area: 3.9 GPM per foot
 - f. Recycled Content: 68 percent.
 - 2. Fabric Face: Non-woven geotextile fabric
 - a. Fiber: Polypropylene
 - b. Flow Rate: 70 GPM per foot of width; ASTM D 4491
 - c. Grab Tensile Strength: 150 lbs (667 N); D 4632
 - d. Puncture Strength: 315 lbs (1.40 KN); ASTM D 6241
 - e. Survivability: Class 3; AASHTO M 288-06.
 - f. Apparent Opening Size: U.S. Standard sieve 70
 - g. Grab Elongation: 60 percent; ASTM D 4632
 - h. UV Resistance: 70 percent at 500 hrs; ASTM D 4355
- B. Three-dimensional, two-part prefabricated soil sheet drain: Hyload HyGro DB 100:
 - 1. Core: High Impact Polystyrene (HIPS)
 - a. Thickness: 1.0 inch nominal (25.4 mm)
 - b. Compressive Strength: 9,000 lbs/ft² (431 kPa); ASTM D 1621
 - c. In-Plane Flow Rate: 80 GPM per foot of width; ASTM D 4716
 - d. Water Storage Capacity: 0.11 GPM per foot
 - e. Perforation Open Area: 8.7 GPM per foot
 - f. Recycled Content: 70 percent.
 - 2. Fabric Face: Non-woven geotextile fabric
 - a. Fiber: Polypropylene
 - b. Flow Rate: 70 GPM per foot of width; ASTM D 4491
 - c. Grab Tensile Strength: 150 lbs (667 N); D 4632
 - d. Puncture Strength: 315 lbs (1.40 KN); ASTM D 6241
 - e. Survivability: Class 3; AASHTO M 288-06.
 - f. Apparent Opening Size: U.S. Standard sieve 70
 - g. Grab Elongation: 60 percent; ASTM D 4632
 - h. UV Resistance: 70 percent at 500 hrs; ASTM D 4355
- C. Prefabricated Vertical and Strip Drains: Provide drains to reduce the vertical and lateral distance water must travel to exit the soil.
 - 1. Vertical Drains: Hyload -W Vertical or wick drains: Non-woven 100 percent polypropylene filter fabric with a structural core extruded from 100 percent polypropylene designed for vertical drain systems. The structural core has a total of 38 longitudinal grooves distributed on both sides to provides discharge passages for water flowing to the surface. The drain is dimensionally stable when wet, has good puncture and collapse resistance and will not shrink or rot.
 - 2. Strip Drains: Hyload -W Horizontal strip drains. Non-woven 100 percent polypropylene filter fabric with a structural core extruded from 100 percent polypropylene designed for vertical drain systems. The structural core is perforated to provides discharge passages for water flowing to the surface. The drain is dimensionally stable when wet, has good puncture and collapse resistance and will not shrink or rot.

2.6 MODULAR VEGITATIVE GREEN ROOF TRAY SYSTEM

- A. Growing Media: light weight engineered growing media designed for use in green roof applications, consisting of organic and inorganic components. Mix shall be approved by Green Roof Outfitters, Inc. or verified to follow FLL guidelines by an independent laboratory experienced with testing vegetated green roof growing media.
- B. Green Roof Module Trays: Green Roof Module Tray as manufactured by Green Roof Outfitters, Inc.
1. Material: 100 percent recycled materials
 2. Tray Dimensions: 24in. x 12in. (609.6mm x 304.8mm)
 3. Tray Depth:
 - a. GROWVista-2 EX6: 6 inches (106 mm) nominal.
 - b. GRWOVista-2 EX8: 8 inches (203 mm) nominal.
 4. Integrated irrigation channels: 1.8 inch by 1.78 inch (45.72 mm by 45.212 mm).
 5. Connection holes: .25 inch (6.35 mm) diameter.
 6. Tray Fasteners: connect trays together using connection holes on tray
 - a. Product: Push Pin - Nylon 66 w/ UV Additive
 - b. Product: Heavy duty UV resistant nylon cable ties
- C. Plantings: Includes mixtures of plants appropriately suited for climate and site specific conditions, and recommended by the Green Roof Outfitters.
1. Pre-grown: vegetated green roof trays are pre-planted in a nursery setting and grown out to desired plant coverage. Modules are planted from a selection of manufacturer's recommended plant lists for regional locations.
 2. On-site planting: green roof trays are filled and planted on-site using a selection of manufacturer's recommended plant lists for regional locations.
 3. Sedum Mats/Tiles: Typical Plant Species List. Plant species and availability may vary by region. Sedum Mats/Tiles typically contain a minimum of 8-10 of the following plant species:
 - a. Sedum spurium 'Fuldaglut' (aka Blaze of Fulda, Fireglow)
 - b. Sedum spurium 'Green Mantle'
 - c. Sedum spurium 'John Creech'
 - d. Sedum spurium 'Red Carpet'
 - e. Sedum spurium 'Summer Glory'
 - f. Sedum spurium 'Tricolor'
 - g. Sedum kamtschaticum
 - h. Sedum kamtsch. 'Variegatum'
 - i. Sedum takesimensis 'Golden Carpet'
 - j. Sedum acre 'Aureum'
 - k. Sedum acre 'Gold Moss'
 - l. Sedum album 'Coral Carpet'
 - m. Sedum album 'Murale'
 - n. Sedum Stefco
 - o. Sedum floriferum 'Weihenstephaner Gold'
 - p. Sedum reflexum 'Blue Spruce'
 - q. Sedum rupestre 'Angelina'
 - r. Sedum sexangulare
 - s. Sedum x Immergrunchen
 - t. Sedum middendorffianum diffusum
 - u. Sedum tetractinum 'Coral Carpet'

4. Custom Plant Selection:

D. Planting Accessories

1. Metal Edge Treatment

- a. Material: extruded aluminum, alloy 6063, T-52, mill finish
- b. Dimensions:
 - 1) For use with GROWVista-2 EX6:
6.5 inches (114.3 mm) high by 3.2 inches (82.6 mm) deep by 8 feet (2.44 m) long.
 - 2) For use with GROWVista-2 EX8:
8.5 inches (114.3 mm) high by 3.2 inches (82.6 mm) deep by 8 feet (2.44 m) long.
- c. Connection Method: Section ends shall splice together with horizontal aluminum sliding connectors.

2. Walkway Pavers

- a. Recycled Rubber Pavers
 - 1) Material: 100 percent recycled rubber
 - 2) Dimensions: 24 inches by 24 inches (609.6 mm by 609.6 mm)
 - 3) Thickness:
 - (a) 1 inch (25.4 mm)
 - (b) 2.5 inches (63.5 mm)
 - (c) 3.75 inches (95.25 mm)
 - (d) 4.25 inches (109.95 mm)
 - 4) Color:
 - (a) Red
 - (b) Green
 - (c) Grey
 - (d) Black
- b. Sustainable Wooden Pavers
 - 1) Garapa (Apuleia leiocarpa) South American hardwood. FSC-certified 100 percent.
 - (a) Dimensions: 23.85 inches by 23.85 inches (606 mm by 606 mm)
 - (b) Height: 1.69 inches (43 mm)
 - (c) Color:
 - (1) Garapa
 - (2) Espresso Garapa
 - 2) Ipe (Ironwood) [FSC-certified] South American Hardwood.
 - (a) Dimensions: 23.875 inches by 23.875 inches (606.425 mm by 606.425mm)
 - (b) Height: 1.69 inches (43 mm)
 - (c) Color: Brown
 - 3) Massaranduba South American Hardwood. FSC-certified 100 percent
 - (a) Dimensions: 23.9 inches by 23.9 inches (606. mm by 606 mm)
 - (b) Height: 1.69 inches (43 mm)
 - (c) Color: Red/Brown
- c. Pre-cast Concrete Pavers
 - 1) Materials:
 - (a) Portland Cement: ASTM C 150 specifications for Portland Cement.
 - (b) Aggregates: All aggregates to meet ASTM C-33 specifications, cleaned and properly graded to size. Aggregates shall be blended to meet individual project requirements.
 - (c) Coloring: Pigments used shall be inorganic, resistant to alkalinity and used per manufacturer's recommendations.

- (d) Reinforcement and Hardware: to conform with ACI and manufacturer's design. Reinforce precast with deformed rods or wire, or both, as recommended by precast concrete manufacturer.
 - (e) Caulks and Sealants: Urethane or Polyurethane sealant. Color to be selected by Architect from standard color pallet.
 - (f) Sealer: Colorless, pure acrylic water-repellent penetrating sealer. Sealer to maintain natural look of concrete surface with no glaze or gloss, darkening or color change.
- E. Irrigation Systems: vegetated roof system manufacturer recommended overhead spray irrigation system.

2.7 VEGITATIVE GREEN ROOF ASSEMBLY BLANKET SYSTEM

- A. Growing Media: Organic recycled material and inorganic by-products for use as a light weight growing media for hardy long lasting succulent or phytoremediation plants that are beneficial in a green roof environment, Material shall be pre-blended regionally and delivered to site for application.
- B. Pre-planted Vegetative Mini Blankets: Hyload Sedum Minimats are organic and inorganic pre-engineered growing medium that enable fast root penetration from the blankets to the substraigh below:
 - 1. Thickness: 1 inch (25 mm)
 - 2. Size: 10 inches by 20 inches or 1 foot by 2 foot
 - 3. Weight: Approximately 2 lbs/SF fully saturated.
 - 4. Plants: Drought-resistant mix of grasses, perennials and groundcovers suitable to a non-or minimally-irrigated installation.
 - a. Mix 1:
 - b. Mix 2:
 - c. Custom Mix: As selected by the Architect.
- C. Pre-planted Vegetative Blankets: Hyload Sedum Blankets SMRM5 are organic and inorganic pre-engineered growing medium that enable fast root penetration from the blankets to the substraigh below:
 - 1. Thickness: 1 inch (25 mm) ????
 - 2. Size: 3.28 feet by 3.28 feet or 6.56 feet by 3.28 feet
 - 3. Weight: Approximately 6 to 8 lbs/SF fully saturated.
 - 4. Plant Mix: Drought-resistant mix of grasses, perennials and groundcovers suitable to a non-or minimally-irrigated installation.
 - a. Octoberfest
 - b. Album
 - c. Ellacombianum
 - d. Floriferum
 - e. Forsterianum
 - f. Silver Stone
 - g. Glaucophyllum
 - h. Hispanicum
 - i. Hydridum
 - j. Czar's Gold
 - k. Kamtschaticum
 - l. Reflexum
 - m. Selksianum
 - n. GoldLocks
 - o. Sexangulare

- p. Spirium
- q. Coccineum
- r. Spurium
- s. Summer Glory
- t. Spurium
- u. Voodoo
- v. Stenopeta;um
- w. Custom Mix: As selected by the Architect.

- D. Pre-planted Vegetative Light Weight Blankets: Hyload Sedum Blankets SMUL6 are organic and inorganic pre-engineered growing medium that enable fast root penetration from the blankets to the substraigh below:
- 1. Thickness: 1 inch (25 mm) ?????
 - 2. Size: 3.28 feet by 3.28 feet or 6.56 feet by 3.28 feet
 - 3. Weight: Approximately 1.75 to 3 lbs/SF fully saturated.
 - 4. Plant Mix: Drought-resistant mix of grasses, perennials and groundcovers suitable to a non-or minimally-irrigated installation.
 - a. Octoberfest
 - b. Album
 - c. Ellacombianum
 - d. Floriferum
 - e. Forsterianum
 - f. Silver Stone
 - g. Glaucophyllum
 - h. Hispanicum
 - i. Hydridum
 - j. Czar's Gold
 - k. Kamtschaticum
 - l. Reflexum
 - m. Selksianum
 - n. GoldLocks
 - o. Sexangulare
 - p. Spirium
 - q. Coccineum
 - r. Spurium
 - s. Summer Glory
 - t. Spurium
 - u. Voodoo
 - v. Stenopeta;um
 - w. Custom Mix: As selected by the Architect.
- E. Pre-planted Plug Plants: Drought-resistant mix of perennials suitable to a non-or minimally irrigated installation.
- 1. Hyload Plug Plants:
 - a. Size: 1 inch with 72 plugs per tray.
 - b. Plant Species: As selected by the Architect.
 - 2. Hyload Master Plugs:
 - a. Size: 3.5 inch by 3.5 inchby 3.5 inch with 18 per tray.
 - b. Plant Species: As selected by the Architect.
- F. Planting Accessories:
- 1. Metal Termination Bars: Extruded aluminum pre-punched at 6 inches on center; 1 inch wide by 1/8 inch thick.
 - 2. Concrete Preparation Materials:

- a. Bonding Bridge. Bonding Agent: Sika - Sikadur 32, Hi-Mod.
 - b. Polymer Modified Patching Mortar:
 - 1) Horizontal Application Product: Sika - SikaTop 122.
 - 2) Vertical and Over Head Application Product: Sika - SikaTop 123.
 - c. Crack Filler: Sika - SikaTop 111.
- G. Walkway Accessories:
- 1. Roof Pavers: Precast concrete, 2 feet (0.6 m) wide by 2 feet (0.6 m) feet long by 2 inches (50.8 mm), thick, 18 pounds per square foot (8.82 kg per sq. m) minimum, and compressive strength of 6500 pounds per square inch (49 Mpa) minimum.
 - 2. Paver Pedestals: Rubber pedestals to elevate the pavers above the surface of the roof membrane and promote positive drainage.
 - 3. Stone Ballast: No.4 size, 1-1/2 inch (38.1 mm) nominal diameter, rounded, water-worn gravel conforming to ASTM D448 and applied at a minimum of 10 pounds per square foot (0.48 kPa).
- H. Irrigation Systems: vegetated roof system manufacturer recommended overhead spray irrigation system.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- 1. Concrete substrate shall be cured not less than 7 days and be clean, dry, and frost free before application of roofing system.
 - 2. Concrete substrates shall have smooth surfaces with no fins or sharp surfaces.
 - 3. Substrates shall be inspected and repaired as needed to provide a proper surface to receive roofing system.
 - 4. Verify items penetrating surfaces to receive waterproofing are securely installed.
 - 5. Verify substrate surface slopes to drain for horizontal waterproofing applications.
 - 6. Identify incompatible substrates, if any.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive roofing.
- B. Clean surfaces thoroughly prior to installation.
- C. Exercise care that structure is not overloaded during application.
- D. Install temporary waterstops at end of each day's work and remove before proceeding with next day's work. Waterstops shall be compatible with materials and shall not emit dangerous or incompatible fumes.
- E. Liquid materials such as solvents and adhesives shall be stored and used away from open flames, sparks and excessive heat.
- F. Verify that drain lines are un-blocked before starting work.

- G. Take necessary precautions when using volatile materials around air in-takes. Coordinate equipment to be turned off and on with Owner if necessary.
- H. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- I. Surface Preparation:
 - 1. Provide a smooth, clean substrate suitable for adhesion of roofing system. Remove substances that could inhibit bonding of membrane and roofing system. Substantially clean substrate to provide a smooth, even surface to greatest extent practical.
 - 2. Remove concrete form release coatings and curing compounds. Contaminants such as dirt, debris, loose materials, moisture, or surface irregularities shall be removed.
 - 3. Grind down projections greater than 1/8 inch. Grind, round off, and smooth sharp corners and edges. Patch and fill voids and holes greater than 1/2 inch with patching mortar.
 - 4. New concrete shall be fully cured before application of membrane sheets.
 - 5. If covering over a previously existing roofing system, substantially remove such that a solid, undisturbed substrate is achieved. Contact Hyload for specific applications.
- J. Surface Priming (only):
 - 1. Apply Hyload Hyprime Primer at minimum rate of 1 gallon per 100 square feet. Allow primer to dry completely.
 - 2. Application of primer shall be limited to what can be covered with membrane in a given workday. Primed areas not covered by membrane during workday shall be re-primed.
 - 3. Re-prime areas contaminated with dirt or dust.
 - 4. Mask adjacent areas to control application of primer. Remove spilled and misapplied primer.
- K. Concrete Joint and Crack Treatment:
 - 1. Cracks in concrete less than 1/16 inch wide shall be pre-treated with a 1/16 inch (60 mil) coating of mastic adhesive 2 inches wide centered on crack.
 - 2. Apply 6 inches Hyproof GL sealing strip membrane centered over cracks wider than 1/16 inch set in 2 continuous 1/4 inch beads of Hyload Structural Sealant, one on each side of crack.
- L. Detailing:
 - 1. Apply 6 inch flashing membrane centered over vertical corners and horizontal to vertical transitions set in 2 continuous 1/4 inch beads of Hyload Structural Sealant, one on each side of corner.
 - 2. Make flashing membrane strips continuous. Overlap end joints by a minimum of 3 inches and either hot air weld or set in continuous 1/4 inch bead of Hyload Structural Sealant inside lap.
 - 3. Seal joints in substrates.
 - 4. Provide a minimum of 3/4 inch Hyload Structural Sealant fillet at inside corners.
 - 5. Provide flashings at changes of plane and around penetrations.
 - 6. Apply a liberal bead of Hyload Structural Sealant at obstructions to continuous sheet waterproofing.

3.3 SHEET MEMBRANE APPLICATION

- A. General Requirements:
 - 1. Proceed with waterproofing application only after substrate preparation is complete. Obtain acceptance of concrete surface from membrane manufacturer's field representative before proceeding with membrane application.

2. Apply and detail waterproofing system in compliance with manufacturer's instructions, recommendations, standard details, and project specific details. Use only proprietary membrane components and materials, as supplied by membrane manufacturer. Form terminations to match manufacturer's standard details including sealed termination bars.
 3. Continuously seal terminations including temporary terminations with Hyload Structural Sealant.
 4. Flash sheet waterproofing system into drains, if any. Make installation 100 percent waterproof.
 5. Ensure waterproofing system is concealed from view in completed work.
 6. Coordinate installation of counter flashings and covering construction.
 7. Apply only as much waterproofing membrane as can be made weathertight each day including flashing work. Do not permit water to penetrate under sheet waterproofing.
- B. Membrane:
1. Exercise care to not trap air pockets under membrane during application.
 2. Roll entire membrane firmly and completely as soon as possible. For horizontal applications, roller shall be a minimum of 30 inches wide and 70 pounds. Roller shall be cushioned with a resilient material such as foam or carpet. For vertical applications, a hand-held roller with rubber or neoprene wheels shall be firmly used.
- C. GL Membrane:
1. Apply 1/2 inch beads of Hyload Membrane Adhesive in a 12 inch intersecting grid pattern.
 2. Lay Hyload sheets over adhesive grid and broom membrane into place over entire area. Exercise care to not flatten beads out paper-thin, maintain a 1/16 inch to 1/8 inch bead profile.
- D. Self-Adhered Top-Ply Membrane:
1. Apply Hyload sheets beginning at low point of roof or center of drain to base sheet following manufacturer's printed instructions.
 2. Exercise care to not trap air pockets under membrane during application.
 3. Roll entire membrane firmly and completely as soon as possible. For horizontal applications, roller shall be a minimum of 30 inches wide and 70 pounds. Roller shall be cushioned with a resilient material such as foam or carpet. For vertical applications, a hand-held roller with rubber or neoprene wheels shall be firmly used.
- E. For Horizontal or Low-Slope Applications:
1. For horizontal, or low-slope applications, apply Hyload sheets from low point to high point so that laps shed water. Perimeters and penetrations shall be picture framed with sheets that run parallel to perimeter or penetration opening.
 2. To greatest extent possible, form minimum 8 inch high curbs at horizontal applications.
- F. For Vertical Applications:
1. For vertical applications, apply Hyload sheets in lengths up to 8 feet and horizontally in shingle fashion.
 2. Terminate membrane a minimum of 6 inches above the vegetated roof surface secured by a termination bar fastened every 6 inches. Cover termination with a membrane counter-flashing.
 3. Where a vertical membrane meets a horizontal substrate extend vertical membrane onto horizontal by a minimum of 6 inches.
- G. Lapping and Joining Sheets:

1. Follow lap guidelines printed on sheet waterproofing.
 2. Adjacent sheets of membrane shall be securely and completely joined together by either hot air welding or by application of Hyload Structural Sealant.
 3. Side laps shall be a minimum of 3 inches end laps a minimum of 9 inches. Stagger end laps by a minimum of 12 inches. Exercise care to avoid stretching sheets as they are applied. If stretched, sheets will recover overnight to their original dimensions.
 4. Hot air weld side laps. Dress end laps with a 1/2 inch bead of Hyload Structural Sealant. Dress T-joints with 1/2 inch beads of Hyload Structural Sealant. In situations where hot air welding of side laps is restricted or otherwise impractical, a finished lap shall be achieved by placing a continuous 1/2 inch bead of Hyload Structural Sealant positioned 3/4 inch from edge under overlying membrane. Set lap by applying sufficient pressure over bead such that it just starts to bleed out from under overlying membrane.
 5. Make minimum 4 inches laps at patches, repairs, and penetrations.
- H. Membrane Flashing:
1. For Horizontal or Low-Slope Applications:
 - a. Flashing membrane shall lap over onto field membrane by a minimum of 6 inches.
 - b. Flashing membrane shall extend vertically a minimum of 9 inches above finished wear surface or grade. Secure top of flashing sheet with a termination bar fastened every 6 inches.
 - c. Junction of flashing to substrate, termination bar, and fasteners shall be covered and sealed with Hyload Waterproofing Mastic applied a minimum of 1/8 inch thick.
 - d. Cover termination with a membrane counter-flashing.
 2. For Vertical Applications:
 - a. Terminate membrane a minimum of 6 inches above grade level secured by a termination bar fastened every 6 inches. Junction of flashing to substrate, termination bar, and fasteners shall be covered and sealed with Hyload Waterproofing Mastic applied a minimum of 1/8 inch thick. Cover termination with a counter-flashing.
 - b. Where a vertical membrane meets a horizontal substrate, extend vertical membrane onto horizontal by a minimum of 6 inches. Terminate a vertical membrane at base of a wall only if bottom elevation of an interior floor slab is a minimum of 12 inches above footing. Seal termination with Hyload Waterproofing Mastic applied a minimum of 1/8 inch thick.
- I. Corners and Intersections:
1. At intersections of one horizontal and one vertical plane forming a 2-way inside corner, or two vertical planes forming a 2-way inside corner, treat inside corner by creating a minimum 3/4 inch fillet, or cant, using Hyload Waterproofing Mastic. Extend mastic onto both horizontal and vertical planes a minimum of 6 inches by 1/8 inch thick. Apply membrane snugly into corner over mastic.
 2. At intersections of one horizontal and one vertical plane, or two vertical planes, forming an outside corner, grind off sharp edges such that a minimum 1/8 inch beveled corner is created. Apply a full sheet of membrane snugly over treated corner during installation.
 3. At intersections of one horizontal and two vertical planes forming a 3-way inside or outside corner, set appropriate pre-formed Hyload Preformed Three Dimensional Shapes into a 1/8 inch continuous bed of Hyload Waterproofing Mastic that extends a minimum of 6 inches in all directions out from corner. Extend vertical and horizontal field sheet of membrane onto cloak by a minimum of 3 inches in each direction.

4. Field membranes shall be secured to Hyload Preformed Three Dimensional Shapes by either hot air welding or by setting field membranes into a 1/8 inch bed of Hyload Structural Sealant that has been applied. Whether hot air welding to cloak or setting membranes in sealant onto cloak, edges of membrane on shapes shall be dressed with a 1/2 inch bead of Hyload Structural Sealant.

J. Penetrations:

1. Apply Hyload sheets to within 1 inch of base of penetration. Dress edge of Hyload sheet with a 1/2 inch bead of Hyload Structural Sealant.
2. Apply a minimum 1/8 inch of Hyload TOM around penetration a minimum of 6 inches onto Hyload membrane and up penetration to just below height of completed overlay.

3.4 INSULATION BOARDS

- A. Place insulation boards, un-adhered, over membrane with drain channels down. End joints shall be staggered.
- B. Boards shall be tightly butted together with no gaps greater 3/8 inch.
- C. Insulation shall be neatly fitted to within 3/4 inch of roof penetrations, projections, cant strips, etc.
- D. When multi-layer insulation applications are involved bottom layer of insulation shall be thickest layer and shall be not less than 2 inches thick. Layers shall be installed unadhered to each other and joints in relation to underlying layers staggered.
- E. No more insulation shall be installed than can be covered and completed before end of day's work, or before onset of inclement weather.

3.5 FIELD QUALITY CONTROL

- A. Employ and pay for services of an independent inspection agency to monitor waterproofing material installation for compliance with Contract Documents and published literature, perform professional consultation, inspections, tests, and other services specified.
- B. Inspections:
 1. Manufacturer's field Representative shall perform continuous inspection of installation.
 2. Include substrate examination, beginning of waterproofing installation, interim inspection, and final inspection prior to installation of vegetative roof materials.
 3. Report inspection results in writing to Contractor, and waterproofing installer, Owner, and Architect on same day that inspections are made. Reports indicating non-compliance shall be sent immediately to Installer, Architect, Owner, and Contractor. Each report shall include:
 - a. Date issued
 - b. Project title and number
 - c. Field representative's name and signature
 - d. Date and time of inspection
 - e. Record of temperature and weather conditions
 - f. Identification of product and Specification Section paragraph reference
 - g. Location of inspection in Project
 - h. Indication of satisfactory compliance with Contract Documents
 - i. Report unsatisfactory conditions or failure to comply with requirements of Contract Documents and shop drawings.

4. Employ and pay for services of an independent inspection agency to conduct Electronic Field Mapping and Testing specified. Testing and inspection agency personnel are not authorized to:
 - a. Revoke, alter, enlarge on, or release requirements of Contract Documents
 - b. Approve or accept any portion of Work
 - c. Perform duties of Contractor
5. Materials and workmanship not meeting specified standard of performance shall be removed and replaced at Contractor's expense, including subsequent repeating of tests and inspections.

C. Electric Field Mapping:

1. Leak detection of horizontal waterproofing shall be done utilizing electrical conduction method (EFM).
2. Provide testing to verify membrane is free of holes, open seams and capillary defects that will allow water to pass.
3. For areas to receive EFM testing provide following:
 - a. Thoroughly wet waterproofing membrane in area of test. Wetting can be accomplished by hand or mechanical spray devices. Membrane shall be wet during testing procedures. Pounded water shall not be necessary.
 - b. Place conductor wire on wetted, bare membrane. Secure wire with small strips of waterproofing or other compatible membrane or tape. Overburden, drainage composites and planting materials shall not be installed prior to testing.
 - c. Allow testing technician to locate membrane breaches, if any. Technician shall mark on waterproofing membrane or surface exact location of defect and assign an identification number to each location.
 - d. Visually inspect entire membrane area and repair breaches found. An EFM retest shall be performed to confirm integrity of repair(s).
4. Technician shall prepare a report of each day's test results containing a written description and photograph of defect(s) located and a schematic CAD drawing indicating location of conductor wire and of defect(s) located in testing field to within 1 inch of accuracy. This report shall be made available in hard copy.
5. Submit written report of EFM tests to Architect within 7 days following testing. Report results of tests, both successful and unsuccessful. In addition to results, report shall include date of test, project name, list of products being applied and tested, name of applicator, name of Contractor, and conditions causing failure of waterproofing in event of an unsuccessful test.

3.6 DRAINAGE PANEL AND VEGETATED ROOF COMPONENT APPLICATION

A. General Requirements:

1. Proceed with vegetated roof component application only after roof waterproofing and testing is complete. Obtain acceptance from membrane manufacturer's field representative before proceeding with application.
2. Install in accordance with membrane manufacturer's instructions and warranty restrictions, if any.
3. Dry all surfaces thoroughly before vegetated roofing work begins.
4. Protect the waterproofing or roof membrane as necessary to prevent damage during application of vegetated roof system.
5. Provide temporary ballast in partially completed sections of vegetated roof to protect overburden from wind effects during installation. Provide ballast with no sharp edges, protrusions, chemical contaminants, or other composition that could damage the waterproof membrane.

- B. Prefabricated Soil Sheet Drains: Place prefabricated soil drains under planters and all areas to be vegetated using the patterns indicated on the Drawings. Provide temporary ballast as necessary for conditions.
- C. Prefabricated Vertical and Strip Drains: Place in pattern indicated on the Drawings. Locate in a manner that promotes free drainage.
- D. Place growing media to the depth required for the pre-planted vegetative media to establish vigorous root development.
- E. Pre-planted Vegetative Media:
 - 1. Install edging, if specified, along perimeter border between vegetation-free zones and vegetated areas. Ensure modules fit tightly within edging perimeter so that modules fit over flange feet.
 - 2. Place modules according to the landscape design, and following the approved recommendations of the manufacturer.
 - 3. Carefully place modules tight against each other in straight rows, utilizing integrated alignment pins for optimal module placement. Attempt to place modules in intended locations and give care to minimize the amount of sliding required for accurate positioning.
 - 4. Module Interconnection: Connect modules together with approved self-locking fasteners in any occurrence where more than one module is adjacent to another.
 - 5. Modules shall be uniformly watered to sufficiently saturate the vegetation and soil media from top to bottom. Water shall be free of substances harmful to plant growth. The contractor shall furnish hoses or other methods of temporary irrigation.
- F. Pre-planted Vegetative Media:
 - 1. Install edging, if specified, along perimeter border between vegetation-free zones and vegetated areas.
 - 2. Place pre-planted media soil sheet drains in pattern approved by the Architect. Do not drag into position. Ensure that media edges are fully in contact with adjacent media with no gaps.
 - 3. After installation, water trays. Comply with manufacturer standards for amount of water, rate of application and degree of saturation. Do not wash growth media out of trays by excess watering.
 - 4. Do not install trays over ponded water, saturated roof surfaces or under freezing conditions.
 - 5. Install roof garden accessories and apply edge treatment as indicated in approved shop drawings.
- G. Overhead Irrigation System:
 - 1. Install irrigation controller unit in location as per irrigation drawings.
 - 2. Install overhead sprayers and supply lines as per irrigation drawings.
 - 3. Test system.
- H. Install pavers on pedestals. Fully support all edges. Shim and adjust pavers to provide level surface.
- I. Ballast: Install ballast in accordance with SPRI RP-4.

3.7 PROTECTION

- A. Protect installed products until completion of project.

- B. Waterproofing: Protect membranes after installation and testing.
 - 1. Eliminate construction traffic on newly tested membrane systems. Do not store construction materials on unprotected membrane surfaces.
 - 2. Trafficking or storing materials on tested membrane can introduce additional damage to waterproofing system and will nullify testing procedures.
 - 3. Membrane areas that are observed to be trafficked or used as a storage/working platform shall be retested and immediately repaired and covered with insulation and drainage composite.

- C. Vegetated Roof Components:
 - 1. Protect installed vegetated roof system from construction traffic and subsequent construction operations.
 - 2. Provide substantial barricades or other barriers where necessary to prevent traffic across vegetation.
 - 3. Maintain plants in vegetated roof for a period of one year after Substantial Completion.

END OF SECTION