SECTION 07 5557

INTENSIVE GARDEN ROOF ASSEMBLY

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install a completed Intensive Garden Roof® Assembly including roof substrate board (if required), surface conditioner (if required), Monolithic Membrane 6125®-FR and flashings, protection course, root barrier protection, STYROFOAM® brand insulation (if required), water retention mat (if required), drainage/water retention component, filter fabric, lightweight engineered growing medium and vegetation.

B. Related Documents and Sections: Examine Contract Documents for requirements that directly affect or are affected by Work of this Section. A list of those Documents and Sections include, but is not limited to the following:

1. General provisions of the Contract, including General and Supplementary Conditions, and Division 01 General Requirements Specification Sections.
2. Section 03 3000 - CAST-IN-PLACE CONCRETE.
3. Section 07 2100 - THERMAL INSULATION
4. Section 07 6200 - SHEET METAL FLASHING AND TRIM.

1.2 DEFINITIONS

A. Green Roof -- An area of planting/landscaping, built up on a waterproofed substrate at any level that is separated from the natural ground by a man-made structure.

B. Intensive Green Roof -- Landscaping requiring regular maintenance, consisting of deeper growing media depths (> 6 inches (152mm) with a wider variety of plant species possible including shrubs and small trees.

C. Garden Roof® -- Patented system of drainage, water retention and root barrier components utilized in the construction of green roofs over Hydrotech's MM 6125® roofing membrane.

1.3 SUBMITTALS

A. Certification from an approved independent testing laboratory experienced in testing rubberized asphalt material, that the material meets the CGSB-37.50-M89 standard for rubberized asphalt membranes, including applicable ASTM procedures.

B. Certification that the roofing membrane has current validation by Underwriters Laboratories, or other approved independent validation service provider, of a minimum 40% recycled content.

C. Certification that the roof membrane assembly is currently Class A listed with Underwriters Laboratories.

D. Certification showing full time quality control of production facilities responsible for the manufacture of the rubberized asphalt and that each batch of material is tested to insure conformance with the manufacturers published physical properties.

E. Certification that the plant manufacturing the rubberized asphalt material has IS0 9001-2015 approval as evidenced by a copy of the official certificate.

F. Certification showing that all components of the green roof assembly are being supplied and warranted by a single-source manufacturer.

G. Certification that the extruded polystyrene insulation if used is free from CFC's.

H. Provide product data on all components of the green roof assembly.

I. Evidence indicating that water is available at the roof level to ensure that the vegetation can receive sufficient moisture through proper maintenance of the green roof.

1.4 QUALITY ASSURANCE

A. The Roofing/Waterproofing Contractor shall demonstrate qualifica¬tions to perform the work of this Section by submitting the following documentation:

1. Certification or license by the membrane manufacturer as a locally based, authorized applicator of the product the installer intends to use, for a minimum of five (5) years.
2. List of at least three (3) projects, satisfactorily completed within the past five (5) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific membrane system proposed for use by applicator.

B. The Green Roof Installing Contractor shall demonstrate qualifica¬tions to perform the work of this Section by submitting the following documentation:

1. Certification or license by the green roof assembly supplier as a locally based, authorized applicator of the products the installer intends to use, for a minimum of five (5) years.
2. List of at least three (3) projects, satisfactorily completed within the past five (5) years, of similar scope and complexity to this project. Previous experience submittal shall correspond to specific membrane system proposed for use by applicator.

C. Include single-source for all components from the manufacturer.

D. The rubberized asphalt membrane product shall contain an inert filler and crumb rubber to enable the product to be resistant to acids (fertilizers, building washes and acid rain) and maintain membrane thickness during application respectively.

E. Membrane Manufacturer shall have available an in-house technical staff to assist the contractor, when necessary, in application of the products and final inspection of the assembly.

F. Membrane Manufacturer Qualifications: Manufacturer shall demon¬strate qualifications to supply materials of this section by certifying the following:

1. Membrane Manufacturer shall show evidence that the specified rubberized asphalt has been manufactured by the same source for thirty five (35) years and successfully installed on a yearly basis for a minimum of thirty five (35) years on projects of similar scope and complexity.
2. Membrane Manufacturer shall not issue warranties for terms longer than they have been manufacturing their hot fluid rubberized asphalt membrane.

G. Green Roof Supplier shall show evidence that the specified green roof assembly has been developed, marketed, supported and installed for a minimum of fifteen (15) years on projects of similar complexity.

H. Green roof supplier shall provide data and calculations, specific to the products being submitted, that verify that the green roof assembly specified meets the project criteria for storm water runoff volume and rate control.

1. Calculations shall be based on actual testing of suppliers green roof components to be used for the project including but not limited to the regionally specific growing media formulation and water retention/drainage materials.
2. Calculations shall account for vegetated and un-vegetated portions of the roof as well as local climatic conditions including rainfall depth, intensity, duration, and timing.

I. Green roof supplier shall provide data demonstrating that the composite C-factor and Curve Number parameters for the specified green roof assembly are less than or equal to those factors used in the engineering design and analysis for the projects drainage and storm water systems analysis.

J. Pre Construction Conferences. The manufacturer will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the roofing assembly.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original unopened containers of packaging clearly labeled with manufacturer's name, brand name, instruction for use, all identifying numbers, and U.L. labels.

B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

C. Store materials in a clean, dry area protected from water and direct sunlight.

D. Store all adhesives at temperatures between 60°F (15.5°C) and 80°F (26.6°C). If exposed to lower temperatures, restore materials to 60°F (15.5°C) minimum temperature before using.

E. Keep roof substrate board dry before, during, and after installation. Outside storage shall be off ground and protected by a breathable waterproof covering. Roof substrate board shall be roofed the same day as installed.

F. Vegetation shall be handled and stored in accordance with the Hydrotech Extensive Garden Roof Plant Installation and Maintenance Guideline.

1.6 PROJECT CONDITIONS

A. Application of the membrane shall not commence nor proceed during inclement weather. All surfaces to receive the membrane shall be free of water, dew, frost, snow and ice.

B. Application of membrane shall not commence nor proceed when the ambient temperature is below 0°F (-17.7°C).

C. Preparation and application of membrane shall be conducted in well ventilated areas.

D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 180°F (82°C) (i.e., hot pipes and vents or direct steam venting, etc.).

E. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use in confined areas without adequate ventilation.

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the roof membrane. Any exposure to foreign materials or chemical discharges shall be presented to membrane manufacturer for evaluation to determine any impact on the roof membrane assembly performance.

1.7 WARRANTY

A. Upon completion of the work, the contractor shall supply the owner with a single-source warranty of U.S. origin direct from the manufacturer.

1. Total System Warranties; covers components of the green roof assembly, including membrane, flashing, insulation, Garden Roof® components, pavers and Checker Block® ballast units. Includes removal and replacement of the insulation, Garden Roof® components, pavers, Checker Block® ballast units and growing media (≤24 inches deep) when supplied by, installed, and maintained per Hydrotech's requirements and replacement of the Hydrotech supplied roof substrate board.
   a. Duration: 10 years.

PART 2 PRODUCTS

2.1 GENERAL

A. Refer to Section 1.05 SYSTEM DESCRIPTION. All components shall be obtained as a single-source from the membrane / green roof manufacturer to ensure total system compatibility and integrity.

1. Manufacturer: American Hydrotech, Inc., Chicago, Illinois 60611-3318

2.2 MATERIALS

A. Membrane: Membrane shall be a hot, fluid applied, rubberized asphalt membrane meeting the CGSB-37.50-M89 standard and other pertinent physical properties:

1. American Hydrotech, Inc., Monolithic Membrane 6125® (40% recycled content)

PROPERTY	TEST METHOD	REQUIREMENT
Flash point	CGSB-37.50-M89 ASTM D-92	< 500°F* (260°C)
Penetration	CGSB-37.50-M89 ASTM D-5329	77°F (25°C) max. 110 122°F (50°C) max. 200
Flow	CGSB-37.50-M89 ASTM D-5329	140°F (60°C) max. 3.0mm
Toughness	CGSB-37.50-M89	≥ 5.5 Joules
Ratio of Toughness to Peak Load	CGSB-37.50-M89	≥ 0.040
Water Vapor Permeability	CGSB-37.50-M89; ASTM E-96, Procedure E	≤ 1.7 ng/Pa.s.m^2 (0.027 perm)
Water Absorption	CGSB-37.50-M89	Gain in weight 0.35 g max.; Loss in weight 0.18 g max.
Low Temperature Flexibility (-25°C)	CGSB-37.50-M89	No delamination, adhesion loss, or cracking

Low Temperature Crack Bridging Capability	CGSB-37.50-M89	No cracking, adhesion loss, or splitting
Heat Stability	CGSB-37.50-M89	No change in viscosity, penetration, flow or low temperature flexibility
Viscosity	CGSB-37.50-M89	2 - 15 seconds
Water Resistance (5 days/50°C)	CGSB-37.50-M89	No delamination, blistering, emulsification, or deterioration
Softening Point	ASTM D-36	180°F (82°C)
Elongation	ASTM D-5329	1000% minimum
Resiliency	ASTM D-5329	40% minimum
Bond to Concrete 0°F (-18°C)	ASTM D-5329	Pass
Resistance to Acid	ASTM D-896 Procedure 7.1 (N-8)	Pass - 50% Nitric Acid Pass - 50% Sulfuric Acid
Resistance to Hydrostatic Pressure	ASTM D-08.22 Draft 2	100 psi (equals 231 foot of head water)
Resistance to Salt Water (20% Sodium carbonate calcium chloride)	ASTM D-896 similar	No delamination, blistering, emulsification or deterioration
Resistance to Fertilizer (Undiluted 15/5/5, nitrogen/phosphorus/potash)	ASTM D-896 similar	No delamination, blistering, emulsification or deterioration
Resistance to Animal Waste	3-year exposure	No deterioration
Solids Content		100% - no solvents
Recycled Content	UL Validated	40% (post-consumer) (30% REACH compliant)
Shelf Life		10 years (sealed)
Specific Gravity		1.15 +.02

* Or alternatively not less than 77ºF (25ºC) above the manufacturer’s maximum recommended application temperature

B. Surface Conditioner

1. Asphaltic surface conditioner for concrete surfaces only; American Hydrotech, Inc., Surface Conditioner

C. Reinforcing

1. Spunbonded polyester fabric (standard duty) reinforcing sheet; American Hydrotech, Inc., Flex Flash® F

D. Flashing

1. 60-mil (1.5 mm) thick, uncured neoprene sheet; merican Hydrotech, Inc., Flex Flash® UN
2. Two-component, liquid applied resin membrane flashing system.
   a. American Hydrotech, Inc., HydroSeal Resin; poly methyl-methacrylate (PMMA) resin

E. Adhesives/Sealants: As standard with the Manufacturer.

1. Combination of a fiberglass reinforced rubberized asphalt protection sheet and polyethylene root barrier.
   a. American Hydrotech, Inc., Hydroflex® 30 and Root Stop HD, or Hydroflex® 30 and Root Stop Bamboo
2. Pressure-sensitive polyethylene tape for Rootstop and Rootstop HD
   a. American Hydrotech, Inc. Root Stop Tape

F. Prefabricated Drainage Course:

1. Composite drainage system consisting of a three-dimensional, crush-proof, drainage core and a filter fabric.
   a. American Hydrotech, Inc., Hydrodrain® 300

G. Insulation:

1. Extruded polystyrene rigid board insulation, as recommended by the roofing system manufacturer
   a. Insulation shall meet ASTM C-578, Type VI or VII.
   b. Minimum compressive strength, ASTM D-1621, 40 or 60 psi (276 or 414 kPa) (variance by type of product)
   c. Maximum water absorption by volume per ASTM C-272, 0.3%
   d. Water vapor permeance for 1" product per ASTM E-96, 0.8 perm (max.) (63 ng/Pa/s/m2)
   e. Insulation shall have an R value of 5.0°F ft2 h/Btu/in. (0.88 K m2/W) of thickness when tested at 75°F (23.9°C) mean temperature in accordance with ASTM C-518
   f. Product shall be free of CFC's

H. Water Retention Mat:

1. Non-woven, synthetic fiber mat capable of retaining additional moisture for potential use by vegetation.
   a. American Hydrotech, Inc., Moisture Mat

I. Filter Fabric

1. Non-woven, polymeric, geotextile fabric.
   a. American Hydrotech, Inc., Systemfilter

J. Growing Media

1. Custom growing media mix capable of supporting vigorous growth of the specified vegetation, complying with the following specification.
   a. American Hydrotech, Inc., Intensive LiteTop® Growing Media

Property	Intensive LiteTop Growing Media*
Grain Size Distribution (ASTM F1632 Method B)	
clay fraction (<0.002mm)	< 3%
silt fraction (0.075-0.002mm)	< 12%
passing #200 sieve (0.075mm)	< 15%
passing #60 sieve (0.25mm)	5 - 25 %
passing #18 sieve (1.0mm)	20 - 50 %
passing #10 sieve (2.0mm)	30 - 60%
passing 1/8-inch sieve	35 - 70 %
passing 1/4-inch sieve	60 - 95%
passing 3/8-inch sieve	95 - 100 %
Density (ASTM E2399)	
Initial Media Density	55 lbs – 75 lbs/cf
Maximum Media Density	76 lbs – 93 lbs/cf
Water/Air Management (ASTM E2399)	
saturated water capacity	> 40%
saturated air content	> 10%
total pore space	> 45%
Water Permeability	
Hydraulic Conductivity	> 10 in/hr
pH, Lime, and Salt Content	
pH (saturated paste)	6.0 – 8.0
EC salts content (water extract)	<3.0 mmhos/cm
Organics (LOI 550°C) (ASTM F1647	
Organic Matter content	6 – 12 %
Compost Fraction	

1) Meet or exceed USEPA Class A standard, 40 CFR 503.13, Tables 1 & 3 (chemical contaminants) and 40 CFR 503.32(a) (pathogens) and/or be permitted in the state of origin to produce Class A material.

2) Meet US Compost Council STA/TMECC criteria or equal for Class I or II stable, mature product.

*Values shall be adjusted due to availability of local materials or special project conditions related to plant selection and/or environmental conditions.

K. Erosion Control Materials (Edit to project requirements, consult Hydrotech)

1. Heavy-Duty Anchors
   a. Plastic anchor disk with connected plastic stem and friction-fit plastic top disk used to fasten GardMat Erosion Control Mat or sedum carpet and tile.
   b. American Hydrotech, Inc. Disk Anchors
2. Hydromulch
   a. Wood fiber-based hydromulch with natural-based tackifier for use in securing sedum cuttings on roof. Where hydromulching equipment is available and has access to roof; hydromulch shall be mixed with tackifier and applied as wet slurry to cutting installations.
3. Dry Hydromulch
   a. Wood fiber or straw-based hydromulch with integrally mixed guar-based tackifier. For use where hydromulching equipment and access is not possible. Dry hydromulch shall be applied in accordance with the Hydrotech Extensive Garden Roof® Plants Installation and Maintenance Guideline.

L. Filter Fabric

1. Water permeable polymeric fabric.
   a. American Hydrotech, Inc., Stone Filter Fabric

M. Miscellaneous

1. Metal Edging
   a. Extruded aluminum edging perforated to allow water flow as shown on plans and details.

2.3 RELATED MATERIALS

A. Intensive plant materials (specified elsewhere) shall be as shown on plans.

B. Metal counterflashing shall be required to provide protection to vulnerable flashing materials from damage due to gardening activities.

PART 3 EXECUTION

3.1 INSPECTION

A. The roofing contractor shall examine all surfaces to receive the roofing assembly to verify it is acceptable and proper for the application of the membrane.

B. The roofing contractor shall not proceed with the installation of the roof membrane assembly until all roof defects have been corrected.

3.2 PREPARATION

A. All surfaces must be dry, smooth, free of depressions, voids, protrusions, clean and free of unapproved curing compounds, form release agents and other surface contaminant.

B. Substrate cleaning

1. Thoroughly sweep the substrate which is to receive the roof membrane.
2. Substrate must also be blown clean using an air compressor to remove any remaining loose debris.
3. Final check to determine if concrete has been properly cleaned is to apply a test patch of Monolithic Membrane 6125® to the surface and check its adhesion.

3.3 INSTALLATION

A. Membrane preparation

1. The membrane shall be heated in double jacketed, oil bath or hot air melter with mechanical agitation, specifically designed for the preparation of a rubberized asphalt membrane.
2. Heat membrane until membrane can be drawn-free flowing at a temperature range between 350°F (176°C) and 375°F (190°C).

B. Detailing/Flashing

1. All detailing and flashing shall be done in accordance with the manufacturer's standard guideline details.
2. All detailing and flashing shall be completed before installing the membrane over the field of the substrate.
3. Roof substrate board joints shall be pre-detailed with membrane and fabric reinforcing prior to full fabric reinforced membrane application.
4. All liquid-applied, resin flashings shall be applied over properly completed membrane flashing details in accordance with the manufacturer’s standard guideline details.

C. Membrane Application

1. Apply the rubberized asphalt membrane at a rate to provide a continuous, monolithic coat of 90 mil minimum (approximately 2.3 mm), into which shall be fully embedded a layer of the spunbonded polyester fabric reinforcing sheet, followed by another continuous monolithic coat of membrane at an average thickness of 125 mil (approx. 3.2 mm). Total membrane thickness shall be 215 mils average (approx. 5.5 mm), 180 mils minimum.
2. Overlap fabric reinforcing sheet 1-2 inches (25.4 mm - 50.8 mm) with membrane between sheets.
3. Pre-detailing of joints between plywood and roof substrate board decks shall be required for warranties greater than 10 years.

3.4 SEPARATION/PROTECTION COURSE INSTALLATION

A. Separation/Protection course shall be installed as follows:

1. Hydroflex® 30 separation/protection course shall be embedded into the membrane while it is still hot to insure a good bond. Installation of a separation course shall be necessary in order to carry out the water test.
    a. Overlap adjoining sheet edges (dry) a minimum of 2"-3" (50.8 mm – 76.2 mm) to insure complete coverage

3.5 MEMBRANE INTEGRITY TEST

A. The roof area or portions thereof shall be leak tested by means of electronic testing or by ponding water at a minimum depth of 2" (50.8 mm) for a period of 48 hours to check the integrity of the membrane installation.

1. VERIFY that the structure can support the deadload weight of a watertest before testing.
2. If leaks should occur the water shall be drained completely and the membrane installation repaired.

B. In the event of excessive damage to the membrane assembly, electronic beach detection testing shall be required prior to the placement of subsequent overburden.

3.6 GARDEN ROOF® COMPONENTS INSTALLATION

A. Root Barrier Protection.

1. Root Stop HD shall be laid over the Hydroflex 30, lapping adjacent sheets 5 feet (1.5 m). A 1 foot (300 mm) overlap is acceptable when Seam Tape is used to continuously seal the lap edges. Root Stop shall be turned up all vertical roofed/flashed surfaces, installing additional material as required, to completely protect waterproofing and flashings.

B. Insulation. Where specified, insulation shall be installed loose-laid in accordance with manufacturer's recommendations.

C. Drainage/Water Retention Component

1. Gardendrain GR50 shall be installed with holes up, over the root barrier protection. Adjacent panels shall be butt together. Gardendrain shall be cut to fit around penetrations, etc. with a heavy-duty utility knife or small toothed saw.
2. The cups of the Gardendrain shall be filled with lightweight aggregate level with the top surface of the panels where required due to loading conditions.

D. Filter Fabric.)

1. A layer of Systemfilter shall be laid over the Gardendrain, lapping adjacent rolls a minimum of 12 inches (300 mm). Enough material shall be left to be drawn up above the anticipated growing media level. Any excess shall be trimmed down to the level of the growing media.

3.7 GROWING MEDIA INSTALLATION

A. LiteTop growing media shall be placed carefully to avoid damage or displacement of other materials such as walls, paving, drainage components, filter fabric, and roofing membrane.

B. LiteTop growing media shall be placed to within 1 inch greater than final grade or to a depth of no greater than 8 inches and compacted as described in 3.08.C. below. For final grades less than 8 inches only one round of compaction shall be performed and remaining growing media loosely placed such that top of growing media exceeds final grade by 1 inch (see 3.08.D. below). For final grades greater than 8 inches, place growing media at no greater than 6 inches and repeat procedure until growing media has been compacted within 1 inch of final grade.

C. Compaction shall be performed with a 300 – 400 lb. landscape roller. Mechanical compactors including plate compactors are not recommended.

D. Where Checker Block® is installed, roller compaction is not possible. Hand compaction shall be employed to properly compact media. After Checker Block® is filled with media, continue media

placement until desired grade is achieved.

E. After compaction remaining growing media shall be placed at 1 inch greater than final grade and thoroughly watered or jetted over entire area. Low settled areas shall be filled with additional growing media and re-wet to achieve uniform prescribed final grade.

F. Erosion Control Mat:

1. The erosion control mat shall be installed directly over the growing media and properly staked into place.
2. Stake fastening pattern is based on local wind speed, building height and roof slope. Contact Hydrotech for specific guidelines.

3.8 VEGETATION INSTALLATION

A. Intensive plant materials (specified elsewhere) shall be installed in accordance with the plans and specifications.

END OF SECTION

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