



SECTION 07 33 63
VEGETATED ROOF SYSTEM

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. Vegetation for green roof systems - sedum tiles/mats
- B. Growth Media for green roof systems
- C. Accessories and components as necessary for a complete installation of the GRO Power Plant Roof System and connection to solar panel system base rails

1.2 RELATED SECTIONS

** Note to Specifier: Delete any sections below not relevant to this project; add others as required.*

- A. Section 32 80 00: Irrigation Systems for Green Roof
- A. Division 07: Roofing section for protection mats for roof membrane and insulation cover boards at pedestal support locations.
- B. Section 07 55 63: Membrane Roofing for Green Roofing Systems
- C. Section 07 55 64: Green Roof Components
- D. Section 07 21 13: Lightweight Expanded Polystyrene

1.3 REFERENCES

** Note to Specifier: Delete any references below not relevant to this project; add others as required.*

- A. ASTM D4355: Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus
- B. ASTM D4491: Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- C. ASTM D4533: Standard Test Method for Trapezoid Tearing Strength of Geotextiles
- D. ASTM D4632: Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- E. ASTM D4751: Standard Test Methods for Determining Apparent Opening Size of a Geotextile
- F. ASTM D4833: Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
- G. ASTM D 4972: Standard Test Methods for pH of Soils
- H. ASTM D5261: Standard Test Method for Measuring Mass per Unit Area of Geotextiles
- I. ASTM D6241: Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related



- J. Vegetated Green Roof System Manufacturer's specifications, plans and guides.
- K. ASTM E2396 Standard Testing Method for Saturated Water Permeability of Granular Drainage Media for Green Roof Systems
- L. ASTM E2397 Standard Practice for Determination of Dead Loads and Live Loads Associated with Green Roof Systems
- M. ASTM E2398 Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Green Roof Systems
- N. ASTM E2399 Standard Test Method for Maximum Media Density for Dead Load Analysis
- O. ASTM E2400 Standard guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems
- P. ASTM E2400 Standard guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems
- Q. ANSI/SPRI VF-1 External Fire Design Standard for Vegetative Roofs
- R. ANSI/SPRI RP-14 Wind Design Standard for Vegetative Roofing Systems

1.4 DESIGN / PERFORMANCE REQUIREMENTS

** Note to Specifier: Vegetated green roofs can be extensive or intensive.*

Extensive Green Roof: Low maintenance landscaping consisting of shallow soil depths (< 6 inches) with plant varieties restricted to sedum tiles/mats.

Intensive Green Roof: Landscaping consisting of deeper soil depths (> 6 inches) with a wider variety of plant species possible including, ornamental grasses, perennials, shrubs and small trees.

Following is an example of an extensive installation with < 6 inches of growing media and GRO drainage components.

- A. Design Requirements:
 1. The vegetated cover shall be sedum tiles/mats on top of a required depth of growing media installed over a layer designed to promote drainage and distribute moisture.
 2. The system dead load, measured according to ASTM D2397, when added to the weight of the roofing membrane system, shall not exceed the maximum allowable dead load for the roof.
- 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 sustainability of the installed vegetation.
 3. Protect roof waterproofing materials from damage caused by exposure to ultraviolet radiation, physical abuse, and rapid temperature fluctuations.



1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data including:
 - 1. Manufacturer's data sheets on each product included in the GRO Power Plant Roof System.
 - 2. GRO Green Roof Maintenance Manual and GRO 2-Year Plant Warranty Maintenance and Requirements.
- C. Shop Drawings: Submit shop drawings showing all components required for the GRO Power Plant Roof System.
- D. Structural Analysis: Provide confirmation of the structural capability and adequacy of the structure to carry the dead and live load weight(s) required, to be provided by Structural Engineer.
- E. Plant list: Identify species, size, and source for each type of plant. Indicate planting method, planting density, and quantity conditions for care during the establishment period.
- F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for warranty and maintenance of vegetated components.

1.6 QUALITY ASSURANCE

- A. Single Source Responsibility: Installation of the GRO Power Plant Roof System components and vegetation shall be provided by a single source.
Components include but are not limited to:
 - 1. Protection fabric layer
 - 2. Drainage panels
 - 3. Filter fabric
 - 4. Growing media
 - 5. Vegetation
 - 6. U Bracket
- B. Installer Qualifications: Installer must have previous construction experience for projects of a similar type. All work must comply with the manufacturer's installation instructions and procedures.
- C. There shall be no deviation from this Specification or the Drawings. Installer assumes liability for any deviations from Specifications and/or Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging with labels intact and legible. Inspect all delivered materials to insure they are undamaged and in good condition.
- B. Sedum vegetated tiles/mats shall be delivered in such a manner as to preserve the quality of the plants. Truck delivery will be conducted in a manner as to protect the vegetated tiles/mats from temperature or wind damage. For transport times less than 1 day, a closed or open trailer may be used. For longer duration transport times, vegetated tiles/mats must be delivered in a climate-controlled trailer, weather and temperature dependent.



- C. Upon arrival, the vegetative sedum tiles/mats shall be immediately off-loaded and moved to a protected area. Ideally, the tiles/mats should be installed within 24 hours of arrival. If installation is not possible in this time frame, then a holding area shall be reserved to unpack and layout the vegetative tiles/mats for exposure to air and light until they can be installed. Once the tiles/mats are unpacked, water them thoroughly once every three days until they can be installed.
- D. Protect the sedum vegetated tiles/mats from weather extremes.
 - 1. If it is hot, move them to a shady location.
 - 2. If harsh winter conditions exist, set them out of the wind and protect them from frost.

1.8 PROJECT CONDITIONS

- A. Sedum vegetated tiles/mats should not be installed when temperatures are below freezing.
- B. When roof temperatures are expected to reach above 100°F (38° C) on a day of installation, install the tiles/mats early in the day when temperatures are lower, or water the roof growing media to lower the temperature just before installation.
- C. Sedum vegetated tiles/mats should not be installed over waterlogged media or installed during prolonged periods of drought unless irrigation is available.
- D. It is the responsibility of the installer to verify load limits for the roof structure prior to installation of the vegetated green roof and components.

1.9 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.10 WARRANTY

- A. Structural drainage board: The manufacturer shall warrant the product from defects for a period of ten years from date of shipment.
- B. Sedum tiles/mats: The manufacturer shall provide a limited warranty for a period of two years from date of shipment per the GRO 2-Year Plant Warranty Maintenance and Requirements document.
- C. Contractor shall warrant the work remain free from defects of labor and materials in conjunction with his work in accordance with the General Condition for this Project for a maximum of two years.

1.11 MAINTENANCE

- A. The vegetated green roof system shall be maintained as required per the guidelines in the GRO Green Roof Maintenance Manual and GRO 2-Year Plant Warranty Maintenance and Requirements document.



PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer/Provider: Greenrise Technologies, which is located at: 1500 Medical Center Parkway, Murfreesboro, TN; 615-907-7460; Email: info@greenrisetech.com; Web: www.greenrisetech.com
- B. Substitutions: Not permitted.

2.2 GRO SEDUM TILES

- A. GRO Sedum Tiles are comprised of a minimum of 12 different sedum varieties grown on a 1" proprietary soil mix using the plants roots as structural backing.
- B. Sedum varieties shall be low-growing and shall be suited to the local or regional climate and conditions.
- C. Tile dimensions: 12" x 24" (+/- 2.0 sq. ft.) and ranges from 1" to 3" in height on delivery, dependent of plant height.
- D. Tile weight: dry weight = approximately 1.5 lbs/ft² and wet weight = approximately 2.0 lbs/ft².
- E. GRO Sedum Tiles shall have a minimum 95% vegetation coverage upon delivery comprised of an assortment of sedum varieties as including:

Sedum acre 'Golden Carpet'	Sedum acre 'Octoberfest'
Sedum album (assorted)	Sedum Ellacombianum
Sedum floriferum 'Weihenstephaner Gold'	Sedum Glaucophyllum
Sedum Forsterianum 'Silver Stone'	Sedum Hispanicum
Sedum Hybridum	Sedum reflexum 'Blue Spruce'
Sedum Sediforme	Sedum Selksianum
Sedum Sexangulare	Sedum spurium 'Coccineum'
Sedum spurium 'Summer Glory'	Sedum spurium 'Voodoo'

2.3 GRO ENGINEERED GREEN ROOF SOIL / GROWING MEDIA

**Note to Specifier: Maximum Water Capacity is a design consideration that will depend on the depth of the media and the type of media selected.*

- A. GRO Engineered Green Roof Soil is balanced blend of mineral aggregates and organic content, designed to retain moisture, manage plant nutrients, and support vigorous growth of the foliage. Additionally, it helps to neutralize acid runoff and maintain pH levels and soil depth.
- B. Blends may vary per geographic region and vegetative growing conditions and are available in bulk, super sacks, or cubic foot bags.
- C. Mineral and organic content includes lightweight aggregates, compost, sand, and perlite. Other macro- and micro- nutrients may be incorporated in the formulation in initial proportions suitable for support the specified planting.
- D. Mixture of mineral and organic components with minimum performance characteristics as follows:

Maximum Water Capacity	≥ 35% (vol)
Total Organic Matter	4-10% (dry wt.)



Grain-size distribution of the mineral fraction:

Pct. Passing US#230 sieve	≤ 10%
Pct. Passing US#60 sieve	≤ 15%
Pct. Passing US#18 sieve	40-60%
Pct. Passing 1/8-inch sieve	50-70%
Pct. Passing 3/8-inch sieve	80-100%

2.4 GREEN ROOF ACCESSORIES:

- A. GRO Filter Fabric is a highly permeable, non-woven, needle punched geotextile separator for green roof systems. Situated between the engineered soil and the drainage layer, GRO Filter Fabric helps prevent the engineered soil from blocking drainage, while still allowing water to flow through the system.

Performance Requirements:

1. Dimensions: 12.5' x 360' ; 4,500 ft²/roll
2. Density & Weight: 4 oz. & 114 lbs./roll
3. Grab Strength: 100 lb.
4. Grab Elongation: 50%
5. Trapezoidal Tear: 50 lb.
6. CBR Puncture Strength: 310 lb./ft.
7. AOS (Max. Avg.): 70 US Sieve
8. Water Flow: 140 gal/min/ft
9. Permittivity: 2.0 sec⁻¹
10. UV Resistance 70%

- B. GRO Structural Drainage Board is a flexible and strong modular open cell drainage option for vegetated green roofs and for use with the GRO Power Plant Roof System. Designed as open shells, these panels encourage infiltration with 95% internal and 62% surface void area available for storm water capture. GRO Structural Drainage Panels are lightweight and easy to install by interlocking horizontally to form a single layer and can flex to conform to curved surfaces.

Performance Requirements:

1. Panel Dimensions: 19 3/4" x 19 3/4" x 1 1/4"
2. Weight: 19.4 oz.
3. Compressive Strength: 12,530 lbs./ft²
4. Discharge Capacity Rate: 809 gpm/ft²
5. Grab Strength: 100 lbs./ft.
6. Grab Elongation: 60%
7. Trapezoidal Tear: 45 lb./ft.
8. CBR Puncture Strength: 250 lb./ft
9. AOS (Max. Avg.): 70 US Sieve
10. Water Flow: 140 gal/min/ft
11. Permittivity: 1.9 sec⁻¹

- C. GRO U Bracket secured to solar panel system base rail

Performance Requirements:

1. 18-gauge G90 galvanized steel
2. 1 3/4" x 2" x 1 3/4" long x 1/2" wide
3. With 1/4" hole on each end to fit #8W stainless steel with self-tapping screws



- D. GRO Protection Fabric is geotextile fabric made from mechanically consolidated, needle punched, 100% recycled polyester fibers. As a layer under GRO Power Plant Roof System, it adds water retention and capillarity properties to the vegetative system and offers protection and puncture resistance for the roof's waterproofing.

Performance Requirements:

1. Dimensions: 6' x 66.7' x 1/8"; 400 ft²/roll
2. Weight: 16 oz/yd²
3. Water Retention: 0.08 gal/ft²
4. Saturation Density: 0.7 lbs./ft²
5. Grab Strength: 170 lb.
6. Grab Elongation: 50%
7. Trapezoidal Tear: 70 lb.
8. CBR Puncture Strength: 590 lb.
9. Pin Puncture: 160 lb.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Substrate must be clean and free of projections and debris that could impair the performance of the installation.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Safety: Installers are solely responsible to comply with all applicable safety and fall protection codes, laws, and regulations as required by federal, state, and local codes and regulations.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Clean surfaces thoroughly prior to installation.
- C. Establish accurate lines, levels, and patterns.
- D. Traffic over the working area shall be restricted and controlled to qualified personnel only. Provide safety signage, barriers, and safety equipment, as appropriate.

3.3 INSTALLATION, GRO POWER PLANT ROOF SYSTEM

- A. Install GRO Power Plant Roof System according to System Provider's written instructions, applicable regulations, approved shop drawings, as specified.

END OF SECTION

