

SPECIFICATION

Green Living™ Technologies (GLT) - Green Living™ Roof Panels

This specification describes the GLT green roof panel system designed to provide a vegetative cover on sloped (<20 degrees) and flat surfaces. Green Living™ Roof Panels can be delivered as a pre-grown system or non-vegetated. Green Living™ Roof Panels are also used as the base for any intensive or roof top garden applications. This specification is intended to be included in any **Sections or synonymous descriptions titled – Vegetative Roof Coverings.**

1. General

1.1 Related Sections

- .1 Section [02700] – [Paving Stones and Ballast]
- .2 Section [02810] – [Irrigation Systems]
- .3 Section [07210] – [Roof Insulation]
- .4 Section [07550] – [Waterproofing Membrane]
- .5 Section [07620] – [Sheet Metal Flashing]

1.2 Installation Contractor

- .1 The Green Living™ Roof Panels should be installed by an authorized agent of Green Living Technologies (GLT) or certified GLT installer or local labor in addition to GLT supervision. In the event the Green Living™ Roof Panels are not installed by authorized agent, GLT shall not be named in any legal actions, disputes or other.

1.3 Proof of Structural Load Bearing Capacity

- .1 An engineer's report confirming the load bearing capacity of the existing structure *must be provided by the client*. Green Living Technologies will not be held responsible if this report is not furnished to the installer. It is assumed that the client has accepted all responsibilities related to the structural integrity of the roof in relation to installing a green roof on top and will not name GLT in any legal actions.

1.4 Plans & Shop Drawings

- .1 The client must provide scale drawings to authorized agent for quotation and design purposes.
- .2 If acceptable scale drawings are not available, Authorized agent or approved alternate will be required to produce said drawings at the client's expense.
- .3 Authorized agent will provide plan and shop drawings to client showing all material terminations, transitions and penetrations.

1.5 Waterproofing Membrane

- .1 There must be an approved high quality waterproofing membrane in place under the GLT roof system prior to installation of the green roof.
- .2 The waterproofing manufacturer must provide written approval of the GLT system for use on their membrane.
- .3 A flood test, or other approved leak detection method, is to be performed prior to installation of the GLT system to ensure the membrane is performing as per manufacturer's specifications. GLT will not accept or is responsible for existing leaks or other issues related to the membrane. A leak test report confirming the water tightness is acceptable and *must be provided by the client*.

- .4 The waterproofing membrane will be covered by a separate warranty issued by the waterproofing provider and will not be covered under the GLT product warranty.
- .5 Green Living Technologies will not be held responsible if this report is not furnished. It is assumed that the client has accepted all responsibilities related to the waterproofing capabilities of the membrane and will not name GLT in any legal actions.

Accessories

- .6 All other components or accessories must be approved or provided by GLT to ensure viability and performance of the system as per the specifications.

1.6 Lead Time

- .1 It can take as long as 6 months of growing season to produce a pre-grown system depending on plant species and propagation method. The decision to purchase a pre-grown system must be made 6 months prior to the installation date to allow sufficient time for this production by a local approved grower.
- .2 Production of GLT components can take as long as 2 months to manufacture. A lead time of 2 months should be anticipated when ordering any components.

1.7 Contract Documents

- .1 In the case where a GLT authorized agent is hired to install the system a signed contract specifying the scope of work, terms and conditions, payment scheduling, warranties, and any other relevant information is required before plant propagation is started.

1.8 Warranty on Workmanship

- .1 A five (5) year standard warranty on workmanship is to be provided by the installer.

1.9 Warranty on Components

- .1 GLT warrants all non-living components of the GLT system will perform as specified for 15 years provided the GLT maintenance program has been followed and any work performed on the system has been done by GLT or a GLT approved agent.
- .2 The 15 year warranty for the root barrier, vegetation carrier/drainage board, filter fabric, water retention, root stabilizer, growing medium and edging details of the GLT system states that these components will not degrade due to physical, chemical or biological processes that naturally occur in a green roofing system. The labor and material cost of any warranty work is covered in this warranty. An extended warranty is available for this portion of the system but must be used in conjunction with the GLT maintenance program performed by a GLT authorized agent.

1.10 Warranty on Vegetation

- .1 A one (1) year warranty and maintenance contract for the approved vegetation shall be provided with the initial quotation for an extra cost. (*All vegetation warranties are voided unless an automatic low volume irrigation system is installed) This will cover all aspects of the vegetation and system performance. An extended warranty (including vegetation) could be available as part of the maintenance program and can be extended for as long as a maintenance program is purchased through an authorized representative.

1.11 Extended Warranty and Maintenance Program

- .1 An extended warranty and maintenance program can be purchased for the GLT system.
- .2 The warranty and maintenance program is available in the form of an annually renewable contract between GLT approved agent and the client. The warranty will cover all system components including plant performance provided that all maintenance has been performed by a GLT approved agent since the date of installation.

2. Products

2.1 Description

- .1 The GLT system is made up of modular sections 109.2 cm (43") by 109.2 cm (43") including overlap areas or 99.1cm (39") by 99.1cm (39") of vegetation area that are delivered as a preassembled product to the site for installation. The plants may be pre-grown into the modules and all components that make up the system are bonded together to maintain structural integrity. The ability to customize and accessorize the system with various options is possible provided the design has been approved by GLT or Approved Agent.

.2 Required Components

- .a Root barrier over the waterproofing membrane (See Section 2.2.3 for exceptions);
- .b GLT high density polyethylene vegetation carrier/drainage board;
- .c Water retention and Root Stabilizer blanket attached to the vegetation carrier with a minimum depth of 7 mm (0.27");
- .d For Pre-Grown systems a GLT approved substrate (minimum depth of 52 mm (2") (Pre-Grown System Only); (15 lbs per sf saturated @ 2" or 52 mm) *As the depth of the substrate increases so will the weight. When specifying weights please contact GLT for approval. *ON AVERAGE THE SYSTEM WILL MAINTAIN BETWEEN 10 AND 15 POUNDS PER SQUARE FOOT SATERATED WITH 2.5 INCHES OF GROWTH MEDIA UNLESS SPECIFIED.*
- .e Established vegetation with root growth. (Pre vegetated only)

.3 Optional Components

- .a Additional GLT approved substrate;
- .b GLT edging details and irrigation accessories.
- .c Custom Plants (planted on site in additional substrate areas)

2.2 Root Barrier

- .1 The system may require a root-blocking sheet to be laid under the polyethylene vegetation carrier. The root barrier must be made of an approved material and be thick enough to resist root penetration. Usually recommended by waterproofing manufacturer.
- .2 Root barrier / protection fabric sheets must be overlapped by at least 60 cm (2') or seamed using approved methods to ensure root blockage

- .3 Some high quality single-ply membranes may provide ample root barrier qualities and may not require the addition of a second root barrier membrane (subject to approval by waterproofing manufacturer).

2.3 Protection Fabric

- .1 Some waterproofing membranes may require a protection fabric be installed above the membrane. This will be applied as per the waterproofing manufacturer's specifications.

2.4 Vegetation Carrier/Drainage Board

- .1 The vegetation carrier must be provided by GLT and meet or exceed the following:
 - .a Made of high density polyethylene that contains at least 50% post industrial recycled materials.
 - .b Class "B" fire rating
 - .c Compressive strength of 3200 lbs f² (150 Kn/ m²)
 - .d Flow rate of 6.868gpm/10.76 f² (3.28' x 3.28') or (26Lpm/m²)
 - .e UV resistant
 - .f Temperature range -40°F to 176° F (-40°C to 80°C).
- .2 There is drainage holes present on the flat surface area between the pockets to allow the overflow from the pockets to drain from the system to the roof drains.

2.5 Water Retention and Root Stabilizer Blanket

- .1 The Water Retention and Root Stabilizer is provided and attached to the vegetation carrier.
- .2 The Water Retention and Root Stabilizer must have a minimum depth of 7 mm (0.27").
- .3 The Water Retention and Root Stabilizer must be made to cover the entire module except for the 2 rows around the exterior of two sides, which are left exposed for the fastening one module to the next. The combined water holding capacity of the light weight Vegetation Carrier and the Water Retention and Root Stabilizer must be min. 0.55 - .60 gal/sq ft).

Description

This multi-function composite consists of a 50% post-industrial recycled polypropylene drainage core of fused, entangled filaments and a specially formulated water retention fabric bonded to one side. The entangled filaments are molded into a square waffle pattern that maintains the flexible design of other Enkadrain products. The composite water retention fabric consists of a 8 oz/yd² - 100% post consumer recycled non-woven polyester fabric mechanically bonded to a 12 oz/yd² layer of synthetic hydrophilic (water) absorbent mat. The absorbent mat is designed to hold 10 to 12 times its unit weight of water. It is a very strong, durable composite that is extremely resistant to puncture and tearing. The composite is inert to biological degradation and naturally encountered chemicals, alkalis, and acids. This product can help contribute up to 2 LEED points when used in conjunction with other recycled content products. As a part of a green roof it can contribute towards additional LEED points by reducing stormwater runoff, heat islands and energy consumption.

Recommended Applications

- Extensive green roofs
- Intensive green roofs
- Exterior & interior planters

Features and Benefits

- Excellent durability
- Protects waterproofing during and after placing of planting media
- Conforms to irregular surfaces and offsets
- Waffle design creates open flow path — even during loading of planting media
- Recycled content polymer in core and fabric contributes towards LEED points
- Provides superior water holding capacity
- Reduces runoff volume in green roof applications

Technical Data

Physical Properties

Property	English Units	Metric Units
Core Material	Recycled Polypropylene	
Total Thickness	0.60 in	mm
Total Weight (avg.)	36.0 oz/yd ²	g/m ²
Core Thickness	0.40 in	mm
Core Weight (avg.)	16.0 oz/yd ²	g/m ²

Flow Rates

Pressure	1.0 Gradient	0.1 Gradient
1000 psf	23.0 gal/min/ft	6.9 gal/min/ft

Fabric Properties

Property	English Units	Metric Units	Test Method
Polymer	Polypropylene Recycled Polyester		
Fabric Color	Light Green		
Weight	20.0 oz/yd ²	g/m ²	ASTM D 5261
Thickness	165 mils		ASTM D-5199
Grab Strength MD	135.0 lbs	kN	ASTM D 4632
Grab Elongation MD	70%	70%	ASTM D 4632
Mullen Burst Strength	300 psig		ASTM D 3786
Puncture Strength	70.0 lbs	0.31 kN	ASTM D 4833
Water Holding Capacity	1000-1200%		ASTM D 4250
Water Holding Capacity	0.10– 0.15 gal/ft ²		ASTM D 4250

Polymer Properties

Polypropylene has excellent resistance to organic solvents, degreasing agents, acids, and alkalines. It has tensile strength superior to high density polyethylene. It has a low moisture absorption rate, is resistant to staining, and is very light weight.

2.6 Substrate

- .1 A locally produced substrate must be applied to the system on top of the Water Retention and Root Stabilizer for the purpose of plant sustainability.
- .2 When weight is a concern lightweight growing medium components may be used to reduce the load on the roof structure.
- .3 Any growing medium required must be approved or provided by GLT or GLT authorized agent to ensure viability and performance of the system as per the specifications.

2.7 Vegetation

- .1 The plant list must be approved or provided by GLT or GLT authorized agent to ensure viability and performance of the system as per the specifications.
- .2 The vegetation with root establishment into the Water Retention and Root Stabilizer and substrate must be mature enough to provide 90% cover upon installation. (Pre-grown system only) **GLT will and can deliver a pre-mature product prior to the required 6 month lead time. Less lead time equates to a less mature product and client assumes a product less than 90% mature to be acceptable.*
- .3 It is possible that climate regions will require growing in a green house. Additional costs may be applied to regulate green house temperatures.

2.8 Irrigation

- .1 Various irrigation solutions are available depending on the situation. All irrigation designs must be approved or designed by GLT or GLT authorized agent.
- .2 An irrigation water source must be provided at the roof level with a shut-off valve installed by certified plumber.
- .3 Grey water or rainwater irrigation water is encouraged for use with the GLT System. Water quality must be approved by GLT or GLT authorized agent prior to installation.

2.9 Edging Details

- .1 Aluminium edging details that fasten to the system are available. This edging detail is designed to be anchored under and over the vegetative carrier. Edge details also have the option of being powder coated or wrapped with a decorative metal such as copper, contact GLT or approved agent for more information.
- .2 Concrete pavers and gravel ballast edging details are available that hold the system down and provide additional weight around the perimeter to help combat any wind uplift and/or to provide access for foot traffic.
- .3 All edging must be approved by GLT for use with the GLT system.

3. Execution

3.1 Delivery

- .1 Co-ordination of delivery time lines is the responsibility of GLT or GLT installer. Two (2) days advance notice of delivery to the producer is necessary to ensure there are no delays.
- .2 The pre-grown modules will be palletized and delivered to site for installation on the date of installation unless otherwise specified.

3.2 Storage

- .1 If the outside temperature is above 25°C (77°F) the modules must be installed within two (2) days after being palletized to prevent damage to the vegetation. If the outside temperature is between 15°C (59°F) and 25°C (77°F) the modules must be installed four (4) days after being palletized to prevent damage to the vegetation. If the outside temperature is between 5°C (41°F) and 15°C (59°F) the modules must be installed eight (8) days after being palletized to prevent damage to vegetation.
- .2 Palletized vegetated material must be stored in a secure, cool shady environment out of direct sunlight prior to installation. Vegetated panels must be protected from rapid temperature changes of more than 15°C (59°F)/hour. All vegetation is to be installed within two (2) days of being delivered. If this is not possible contact GLT for further instructions.
- .3 All other materials (non-living) should be stored in a dry location out of direct sunlight with original packaging and documentation left intact prior to installation.

3.3 Site Protection

- .1 The roof membrane is to be protected from damage by first sweeping off all debris and then laying protective paneling in work and traffic areas. Any damage to the roof membrane during construction is the responsibility of or GLT authorized agent.
- .2 Heavy materials are only to be placed in designated areas on roof which have been approved by a structural engineer to be suitable to carry the specified load. If there are no areas that can support additional weight then all loads must be “floated” above the roof surface by lift, never to set the load down on the roof.

3.4 Installation

- .1 The root barrier and/or protection sheet (if required) must be placed over the membrane in the area being greened.
- .2 The modular trays can then be picked up by two individuals and placed in the proper area. A wagon or cart may be used to move multiple trays to the designated area provided this doesn't exceed load restrictions of the roof.
- .3 The panels must be overlapped by two pockets.

3.5 Maintenance

- .1 Maintenance must be provided by a GLT approved agent.
- .2 A maintenance contract beginning from the completion of system installation and is provided with initial quotation by the installer or GLT authorized agent as an additional cost.
- .3 Maintenance work done by an unapproved GLT agent may void any warranties made by GLT.
- .4 Additional maintenance programs and costs are subject to the type of plant species and growing mediums specified for the project.
- .5 All maintenance contracts are subject to annual renewal. Failure to renew the maintenance agreement with GLT approved agent voids all vegetative warranties.
- .6 Every year the client renews the maintenance agreement GLT approved agent will renew the vegetative warranty.
- .7 Upon completing the 15 year non-vegetative warranty every year the client renews the maintenance agreement GLT will continue to warranty the non-vegetative components in addition to the plant material.