



LiveRoof STANDARD System Specifications

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**LiveRoof, LLC
P.O. Box 533
Spring Lake, MI 49456**

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Module Size

LiveRoof Standard: 1' x 2' x 3 1/4" (soil height approximately 4 – 4 1/4") Soil fills soil elevator, plants and soil obscure module edges.

Module Weight

14 oz./sq.ft.

Material

100% post-consumer recycled polypropylene
100 mil. thick walls. No VOC content, extraction distance from manufacturer Lansing, Michigan 100 miles. Location of manufacturing 14 miles from distribution.

Water Dispersal

Appx. 10.0 gal. per min. per lineal foot. Hi-Flow option available with standard module.

Module Color

Black or gray.

Weight Vegetated

Approx. 27-29 lbs./sq. ft.

Drainage

Positive drain holes, at lowest point in module.

Soil Media

Proprietary LiveRoof® specified engineered soil, based upon German FLL granulometric specifications, 94+% by dry weight inorganic content for minimal shrinkage/ decomposition. (92% in British Columbia). Dry weight approx. 60-65 lbs/cu. ft. Verify with local grower.

Acceptable Protective Underlying Materials

Modules to be placed directly upon heavy duty (HDPE, Polypropylene, TPO, EPDM or recyclable PVC) slip sheet/root barrier of 40-60 mil. thickness with effectively bonded seams. This is placed as an additional protective barrier above roof waterproofing membrane. Confirm suitability of waterproofing membrane with manufacturer. Alternatively low profile drain boards work well and manufacturers of cold fluid applied reinforced urethane membranes typically warrant their systems for use in conjunction with LiveRoof® system. In cases where Electric Field Vector Mapping may be desired, a fiber backed drainboard, such as Enkadrain may be used. Fiber backed drainboards are only recommended with the Lite and Standard LiveRoof systems and only when vegetated with Sedums or Sempervivums, as such plants are sparsely rooted and not prone to rooting into the fiber of the drainboard.

Irrigation System

Recommended for backup during prolonged hot dry windy weather patterns. Simple overhead system with LiveRoof GreenPipe™ is inexpensive and effective insurance. Irrigation requirements are dependent on plant selection, climate and roof design.

Edge Treatments

Coengineered RoofEdge® aluminum edging with adequate drain perforations recommended. Any edging should allow for adequate drainage.

Plants

See LiveRoof.com for grower in your region, for specific recommendations.

Conveyance Method

Empty LiveRoof® modules to be stacked on their sides during shipping. Pre-vegetated modules to be delivered by Hoppit® or other appropriately engineered conveyance device.

PART 1: GENERAL

1.1. SCOPE

Provide equipment, materials, tools, and labor to install vegetated roofing modules. Modules to include growth media and plants. This work shall also include edge treatments, custom shaping of modules, and installing paver stones or ballast, slip sheet/root barrier and irrigation system, if specified.

1.2 SUBMITTALS

- A. Product data for vegetated roofing systems.
- B. Planting mix design indicating species.
- C. Shop Drawings: Indicating layout of modules, pavers, irrigation, and square footage.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- E. Maintenance instructions for inclusion into owner's manuals.

1.3 QUALITY ASSURANCE

- A. No deviation should be made from this specification. Installer assumes liability for any deviations from specification.
- B. Only LiveRoof® certified installer personnel shall complete all work.
- C. Prior to installing LiveRoof® modules, the following procedures are to be conducted:
 - 1. The building Owner, Architect, or Engineer shall verify that the roof is properly designed and constructed to adequately support the load of the LiveRoof® system.
 - 2. The roof is to be flood tested for water tightness for 24 hours. Water testing shall be witnessed and confirmed in writing by Owner's Representative and/or Design Professional, Waterproofing Contractor, Membrane Manufacturer, and Installation Contractor.
 - 3. Slipsheet/root barrier to be properly installed, seams overlapped and bonded, in accord with architect's and manufacturer's specifications.
 - 4. The roof is to be inspected and determined ready to accept the LiveRoof® modules by a Technical Representative of the Installer.
- D. Once the LiveRoof® installation is completed, an inspection is to be conducted by a Technical Representative of the installer to verify that the LiveRoof® modules have been installed tight against each other, in straight rows, corners aligned, properly oriented, and tight against the edging.

1.4 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section. Review LiveRoof standardized procedures with supervisory staff.

1.5 DELIVERY, STORAGE, HANDLING, PROTECTION

- A. LiveRoof® modules are to be delivered in good condition free from shipping damage.
- B. LiveRoof® modules are to be kept out of the sun if plastic wrapped to prevent overheating.
- C. LiveRoof® modules are to be installed on the roof top within 4 hours of delivery.
- D. On the job site, LiveRoof® modules are to be handled to prevent damage to the modules themselves and all roofing components.
- E. LiveRoof® modules are to be conveyed to roof surface with equipment designed to carry the collective load of the LiveRoof® modules and transport vehicle or Hoppit®. Account for decreasing load limits when boom (of crane or fork lift) is extended. Use crane stabilizers and take all necessary precautions to protect building and personnel.
- F. Never exceed the load capacity of the roof deck when placing LiveRoof® modules on the roof.
- G. When suspending LiveRoof® modules and conveyance vehicle above deck, take precautions to stabilize and prevent twisting of conveyance vehicle. Four tires or two four inch thick sheets of styrofoam is recommended.
- H. During installation, protect the roof deck and membranes with appropriate material such as plywood sheeting. Never scrape or puncture slip sheet or membranes. Keep roof surfaces free of soil, grit, or debris at all times with broom. Never set LiveRoof® modules on top of soil, dirt or grit.
- I. Transport conveyors to be run parallel to the line of installation.
- J. Transport carts to have pneumatic tires, to be wheeled about only upon protective plywood sheeting, and to be loaded so as not to exceed weight capacity of roof deck.

PART 2: PRODUCTS

2.1 VEGETATED ROOFING MANUFACTURER

- A. Provide vegetated roofing systems from the following manufacturer.
 - 1. LiveRoof, LLC
Subsidiary of Hortech, Inc.
P.O. Box 533
Spring Lake, MI 49456
(800) 875-1392
Fax: (616) 842-1392
- B. 100 mil. thick (sidewall) recycled polypropylene and colored black or gray. 1 foot x 2 feet outside diameter, 3 inches tall. The LiveRoof® Soil Elevator™, the insert collar that allows for growing soil above the container edge, is approximately 3½" tall, 16 mil. thick, and composed of recycled polyethylene or suitable biodegradable material. Each module is to be filled to the top of the Soil Elevator™. Soil height from container bottom is approximately 4¼ inches, although normal settling is to be expected and will reduce this height somewhat.

- C. Saturated weight with mature vegetation: approximately 27-29 lb. per square ft.
- D. Module clearance above roof deck: ½ inch.
- E. When prevegetated at a Nursery, the Nursery is to execute the following:
 - 1. LiveRoof® Soil Elevator™ is to be properly inserted into fasteners inside LiveRoof® module.
 - 2. LiveRoof® module is to be filled with LiveRoof® soil and appropriately settled either by mechanical vibration or flooding with water. Any settled soil is to be replaced so that LiveRoof® soil extends to top of Soil Elevator™ at time of planting.
- F. LiveRoof® module is to be filled with LiveRoof® plants, selected by purchaser. Plants are to be grown to maturity (approx. 95%+ soil coverage).

2.2 GROWING MEDIUM

Growing medium is an engineered blend of inorganic and organic components based upon German FLL granulometric guidelines modified so as to contain ecologically sustainable levels of organic content.

2.3 PLANTS

LiveRoof® recommended plant mixes consisting of highly drought resistant ground covers. Local Horticulturists should be consulted for specific recommendations.

2.4 ACCESSORIES

- A. Pavers/Ballast
 - 1. To be of compatible size, design and appropriate weight. co-engineered pavers recommended.
- B. Edging: L-shaped extruded aluminum RoofEdge® with perforations for drainage. For LiveRoof Standard, RoofEdge® is 4½” x 3” with a minimum gauge of 210 mil. Edging, regardless of type, must allow for adequate drainage via sufficient drain perforations.
 - 1. Edging required between modules and stone ballast or pavers. System, however, requires no edging.
 - 2. If edging is attached to LiveRoof modules, use 10-24 x 1” wafer head self-tapping screws in gray spex finish.
- C. Irrigation System
 - 1. System to be used only to keep LiveRoof® in optimal condition during prolonged periods of heat and drought and to optimize the evaporative cooling effect of LiveRoof® during such weather events.

Sloped LiveRoof applications will drain more quickly, thus potentially thinning plants and exposing soil to erosion, and therefore will have an increased need for irrigation.

Reflective walls or windows will increase effects of sun exposure on plants and may require special plant selections and/or more frequent irrigation. Consult a LiveRoof Affiliate Grower for appropriate plant

selections for use next to reflective surfaces.

LiveRoof® recommends either a standard SCH 40 PVC subterranean, or surface applied SCH 40 PVC GreenPipe® (Polyvinyl Chloride Plastic) pipe for irrigation lines, with SCH 80 solvent weld PVC fittings. MP Rotator or equivalent irrigation head recommended.

Consult a qualified irrigation specialist to determine appropriate design configuration of irrigation, including pipe diameter, layout, head style and spacing.

- a. Function: fully automatic or manual.
- b. Controls:
 1. Automatic rain sensor optional.
 2. Irrigation controller shall be outdoor-type.
 3. All sprinklers will have matched precipitation on the same zone.
- c. Piping:
 1. Surface applied irrigation pipe and fittings must be UV resistant, preferably colored green to blend in with the plants. LiveRoof® recommends GreenPipe™ for surface applications. Brace irrigation lines as needed using T-fittings.
 2. For subterranean irrigation, use a v-shaped hoe to dig a trench into the soil at the Moisture Portals™. Lay the irrigation pipe in the trench and fill in soil and plants over pipe.

For subterranean irrigation against a parapet or building wall, place irrigation lines between modules and parapet or wall. Lay filter fabric over pipe assembly and cut to height of modules. Cut holes in filter fabric as needed to fit over irrigation heads. Fill with LiveRoof® Engineered growing medium or stone ballast. Remove soil elevators unless advised that they are biodegradable.

- d. Valves:
 1. A master valve shall be installed on the mainline after the backflow device.
 2. All valves to be covered by a 6" valve box.
 3. All wire connections to be waterproof, UL approved.
 4. To be a manual drain type. Install automatic freeze protection drain valves on all main and lateral piping.
2. Irrigation System Maintenance
 1. System to be blown out with compressed air no greater than 60 psi annually in fall prior to reaching freezing temperatures.

PART 3: EXECUTION

3.1 LIVEROOF® INSTALLATION MUST BE CONDUCTED BY LIVEROOF® CERTIFIED INSTALLER

3.2 PREPARATION OF ROOF SURFACE

- A. Slip sheet/root barrier, specified by architect and approved by manufacturer, of 40-60 mil. thickness with overlapped and effectively bonded seams to ward against root penetration and to keep waterproofing layer safe and clean from soil during installation. Slip sheet/root barrier typified as follows:

Welded Seam Types (40 mil or greater thickness)

- TPO, with seams heat welded
- PVC, with seams heat welded
- Polypropylene, with seams heat welded
- HDPE, with seams heat welded

Glued Seam Types (40 mil or greater thickness)

- EPDM, with seams overlapped a minimum of 3 inches and glued with roll out adhesive or double sided tape adhesive of the type that is impervious to and not affected by moisture, and recommended by the manufacturer.
- Low profile drain board such as Dow (appx. 17 mil. thickness), with edges overlapped 3 inches and glued with manufacturer approved adhesive.

Confirm compatibility of slip sheet and waterproofing membrane with manufacturer.

Never use duct tape or any other adhesive not recommended by the manufacturer.

Never use moisture holding fabric, such as needle punched polyethylene or felt, under the LiveRoof™ system. Such materials:

- Are impossible to sweep during installation.
- Stay wet and encourage root growth and root penetration, and could lead to impeded drainage; especially detrimental if a woody plant were to become established; such plants have woody root systems and potentially could cause roof leaks.

- B. Experienced Contractor to install slip sheet/root barrier in accordance with manufacturer's recommendations.
- C. All surfaces to be smooth, free of debris, soil, and grit prior to placing modules. All materials to be tested water tight and free draining prior to module placement.
- D. All surfaces to be maintained clean and free of debris, soil, and grit during installation process via use of broom. Never walk upon such materials as they may damage membranes.

3.3 INSTALLATION SEASON

Module Installation to be conducted when plants are:

- A. Properly adapted and acclimatized to local weather conditions.
- B. When weather is above 35° F and there is no ice on the roof and LiveRoof® soil is unfrozen.

3.4 DELIVERY, STORAGE, HANDLING, PROTECTION

Before working on roof, all Installers and Laborers to be:

- A. LiveRoof® modules are to be delivered in good condition free from shipping damage.
- B. LiveRoof® modules are to be installed on the roof top within 4 hours of delivery.
- C. Keep LiveRoof modules out of sun on job site if plastic wrapped to avoid overheating.
- D. On the job site, LiveRoof® modules are to be handled to prevent damage to the modules themselves and all roofing components.
- E. LiveRoof® modules are to be conveyed to roof surface with equipment that is designed to carry the collective load of the LiveRoof® modules and transport vehicle or Hoppit®. Account for decreasing load limits when boom (of crane or fork lift) is extended. Use crane stabilizers and take all necessary precautions to protect building and personnel.
- F. Never exceed the load capacity of the roof deck when placing LiveRoof® modules on the roof.
- G. When suspending LiveRoof® modules and conveyance vehicle or Hoppit® above deck, take precautions to stabilize vehicle and prevent twisting of conveyance vehicle or Hoppit®. 4 to 8 tires layed on the deck are recommended.
- H. Surround area below conveyance vehicle and/or crane with caution/stay clear tape to prevent potential injury.
- I. During installation, protect the roof deck and membranes with appropriate material such as plywood sheeting. Never scrape or puncture slip sheet or membranes. Keep roof surfaces free of soil, grit, or debris at all times with broom not blower. Never set LiveRoof® modules on top of soil, dirt or grit.
- J. Transport carts to have pneumatic tires, to be wheeled about only upon protective plywood sheeting, and to be loaded so as not to exceed weight capacity of roof deck.

3.5 SAFEGUARDING SYSTEM INTEGRITY

Before working on roof, all Installers and Laborers to be:

- A. Properly instructed in safety procedures and provided LiveRoof Guide to Standardized Installation Procedures.
- B. Instructed to keep all work surfaces clean and debris free.
- C. To report immediately any damage to membranes, protective sheeting, or drain elements to supervisor, and to make appropriate repairs before proceeding.

- D. Instructed in proper methods of LiveRoof® installation by certified representative of installation company.

3.6 LAYING (PLACING) MODULES

- A. LiveRoof® module installation to follow behind installation of slip sheet/root barrier, irrigation system, pavers, ballast, and edging.
- B. LiveRoof® installation to be conducted in strict accordance with LiveRoof® installation guidelines. Rows to be straight, modules to be tight against each other with edges overlapping and arranged in proper directional orientation. LiveRoof® Soil Elevators™ removed only when individual modules are completely surrounded by L-shaped edging **RoofEdge** edging, or other LiveRoof® modules, so as to prevent soil spillage. NOTE: If biodegradable Soil Elevator™ is used, then Soil Elevator™ is left in place.
- C. LiveRoof® module installation to be conducted in accordance with green roof design.
- D. LiveRoof® modules to be placed directly on top of appropriate slip sheet/root barrier.
- E. It is recommended that any custom cutting/fitting be oriented on the high side (top), or sides of the roof. It is recommended that the cut side of the module be set tight against the edging or toward the side of an intact module so as to prevent soil spillage. If custom cutting must be done on the low, draining, side of the roof, it is imperative that no filter cloth be inserted as it could impede drainage. It is best to orient the cut side against another module, facing upstream.
- F. After installing modules, they should be immediately watered so as to thoroughly moisten the media from top to bottom. Water shall be of suitable quality for plant growth and irrigation system or hoses and sprinklers may be used for such purpose. Note: it takes approximately 1 inch of water, or 1¼ gallons per module to moisten each module thoroughly.

3.7 MAINTENANCE

- A. Documentation
 - Record all green roof maintenance events. Include name of person, date and activity.
 - 1. If fertilizer, record type and amount applied per 1000sf
 - 2. If soil test, record lab
 - 3. If irrigation, record duration and quantity
- B. Annual Maintenance
 - 1. Soil Testing and Fertilization.
 - During April 1 to 15 of each year, administer an annual soil test for PH and fertility levels.
 - a. Maintain pH in the range of 6.5 to 8.0. In the event that pH is outside of the 6.5 to 8.0 range, consult LiveRoof, LLC for the appropriate amendment.

- b. Maintain fertility in the normal range using a typical field soil fertility test as provided by A&L labs. When indicated, apply a single springtime application of Nutricote 14 14 14, Type 180 (180 day release period), at 20lbs per 1000sf. Follow the Nutricote labeled directions for application rate, which take priority over any recommendations listed here. Runoff potential does exist and should be evaluated by the applicator in accord with the site specifics; the greater the runoff sensitivity, the lower the application rate. All applications of fertilizer are the sole responsibility of the applicator.

C. Irrigation

1. Watering

Even in the northern temperate zone of North America, successive watering may sometimes be needed to keep LiveRoof® alive. Protracted hot dry weather can result in plant thinning or death. In warmer climates, depending upon rainfall and exposure, regular irrigation will probably be required. Regardless of geography, LiveRoof® recommends the installation of an irrigation system that is appropriate to the scale of the project and able to allow for rapid and efficient irrigation when needed as a “temporary” management tool under the following conditions:

Prolonged hot dry weather, in the northern temperate zone, is generally defined as periods of 75 degree weather, with less than 1” of rainfall persisting for 4 weeks or longer. This time period will likely be less if the temperatures are hotter, the climate warmer, on sloping rooftops, or roofs exposed to strong winds. Such conditions can dry out the green roof substrate and cause the plants to go dormant or to dry up and die. Dormant plants tend to shrink to a smaller size and expose soil, which can predispose the system to weed encroachment.

NOTE: There are no absolutes when it comes to irrigation. Check the plants for wilting in the morning rather than midday. Irrigate thoroughly to runoff to remoisten entire soil profile if the plants show signs of wilting in the morning.

In areas of reflected light, such as next to south facing walls, more frequent irrigation should be applied to keep the soil from becoming excessively dry.

D. Inspections and Plant Care Protocol

Conduct the following EVERY 2 WEEKS (twice per month) During the entire Spring through Fall Growing Season

1. Conduct hand weeding during the twice monthly inspection. Pull all weeds, never allow any weed to flower, set seed and complete its life

cycle. Weeding should be conducted spring through fall in areas where the roof becomes frozen and snow-covered in winter. In warmer climates, it should be continued year round.

The interval may be adjusted in accord with seasonal variations in weed growth, but the interval should never exceed 2 weeks or be long enough to allow for weeds to flower and set seed. Never allow woody plants to establish in a green roof system as their root systems are extensive and can damage roof membranes.

Herbicides, whether pre-emergent or post-emergent, are not recommended as they are not healthy for the environment and can contaminate runoff. A need for pre-emergent herbicides is a sign of weeding too infrequently.

2. Displaced Soil

Any displaced soil, typically due to nesting birds, should be immediately replaced.

3. Drainage Inspection

Roof drains should be cleared of any debris, pebbles, leaves, etc. during the twice monthly inspection to keep drains flowing freely.

4. Debris / Trash Removal

Remove immediately debris or trash during twice monthly inspection. Especially during fall and spring, rake LiveRoof® planting clean of any matted tree leaves to prevent smothering.

5. Pesticides

Pesticide use is discouraged and should always be considered secondary to cultural and biological control measures, as pesticides can get into runoff water and cause environmental damage. Pesticide use should only be conducted by qualified and licensed applicators, and on an “as needed” basis. All applications of pesticides are the sole responsibility of the applicator.

6. Optional Mowing

If desired, around April 1, mow the green roof to a height of 2” or less. The clippings should stay on the roof. Do not bag and remove. USE PROTECTIVE EQUIPMENT.

7. Wintertime

Avoid applying salt and other deicing agents to LiveRoof plantings. Avoid walking on frozen plants and roof surfaces.

- E. Apply slow release fertilizer as needed in accord with manufacturer’s directions. Avoid runoff into sensitive areas.

3.8 ACCEPTANCE

- A. Conduct post installation inspection to determine acceptance of modules. Inspection to be made by General Contractor’s Representative or by Owner’s Representative upon General Contractor’s request; five working days notice required.

B. Upon acceptance, Owner assumes responsibility for module/plant maintenance.

3.9 CLEAN UP

A. Throughout installation, keep all work surfaces clean and free of grit, dirt, or debris. Use broom not blower, do not sweep soil under modules or slip sheet. Following installation, remove all excess materials and tools from job site. Ensure that any damage that occurs as a result of installation is appropriately and immediately repaired.