LiveRoof®

PREVEGETATED
INVISIBLE-MODULAR
GREEN ROOF SYSTEM

# LiveRoof® Installation
## Guide of Standardized Procedures

# Introduction

The LiveRoof® prevegetated green roof system is simple and easy to install, but like everything else, it can be done well or poorly. At LiveRoof we want to make sure that each LiveRoof system is installed properly every time, so we developed these standardized procedures. These will help you plan for and correctly install the LiveRoof® green roof system.

Each time you install a LiveRoof®, you should bring this LiveRoof® Installation Guide of standardized procedures and follow it step by step. It is the consistent execution of these Standardized Procedures that will create:

- Optimum performance and best appearance
- Maximum value and customer satisfaction
- A great reputation for the LiveRoof® brand, your company and staff

## Why Green Roofs?

Green roofs have become popular for both their financial and environmental benefits.

- Green roofs protect the roof from the sun, wind, heat, and cold and can extend the life of the roof by up to 40 years
  When you consider that the average life expectancy of a roof may be only 15 years, and it may cost as much as 20 dollars per square foot to replace a worn out roof, it is easy to see that green roofs make financial sense.
- Reduce air conditioning costs by 25% or more (for the floor under the green roof)
- Reduce or eliminate storm water discharge fees
- Allow building owners to sell or rent their properties more easily

## From an Environmental Perspective

- Green roofs help to reduce the effects of Global Warming
- Release oxygen and absorb green house gases
- Keep pollutants out of lakes and streams
- Absorb sound and reduce noise
- Help to replace the plants that existed before the building was built
- Provide natural views, helping to make people calmer, happier and more productive

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## Why Choose LiveRoof® for Your Green Roof?

LiveRoof® is a unique patent pending green roof system with prevegetated "invisible" modules. It arrives fully grown for an instantly mature green roof! Other systems require you to start with a brown roof (in other words bare soil and small plants) and grow the roof to maturity - a process that often takes more than 3 years. But LiveRoof is pregrown; there is no longer a need to spend years farming the rooftop trying to make it green. And unlike other modular green roof systems, LiveRoof® is invisible and subterranean so it is attractive and natural looking. It is also sheltered from the sun so it will last indefinitely.

Because LiveRoof® is fully grown, the very day of installation it pays dividends through reduced maintenance, immediate evaporative cooling, erosion control and most importantly owner satisfaction.

LiveRoof® is also unique in that is was developed by a team of horticulturists, roofers, architects, and material handling experts. It uses the finest green roof soil and plants, and is expected to last indefinitely (not a few years like some systems).

You should be proud to be part of each and every LiveRoof® installation and always strive to conduct the installation as precisely as possible. The LiveRoof® standardized procedures are intended to help you to do just that.

### Disclaimer:

Of course, each roof design is unique and you will have to use your expertise and judgment to cope with the nuances of each job. You should always adhere to proper roofing and horticultural principles and realize that, as the installer, you are responsible for the quality of each LiveRoof® installation.

Similarly, you must always protect the integrity of the water-proofing system and building, protect the plants on the job site before and during installation, and properly install accessory components (like edging, irrigation and pavers), as well as the actual LiveRoof® modules.

We hope that the following standardized procedures will serve you well as you represent your company, the building owner, and the LiveRoof® brand. At LiveRoof® we take great pride in the quality of our system. We hope that you will take great pride in the quality of your installations, and in the knowledge that by installing LiveRoof® you are helping to make the world a better place.

# LiveRoof® Installation Standardized Procedures

The following Standardized Procedures represent the steps that you should follow when installing the LiveRoof® system.

## Step A

### Advance Preparation

Always prepare for your LiveRoof® installation long before the LiveRoof® modules ever get to the job site. This will save you time and money, and ensure maximum quality.

Be committed to timely communication. Stay in touch with your LiveRoof® grower and the contractor or owner who hired you to do the installation.

Determine how many modules you will install each day and schedule delivery with your LiveRoof® grower 2 to 3 weeks in advance so the grower can make arrangements for trucks and drivers.

Know in advance who will install the protective slip sheet/root barrier and plan to follow the architect's specifications. Next ensure that the protective slip sheet/root barrier is pre-approved by the manufacturer of the waterproofing system. Normally the slip sheet will be 40 mil. thick or thicker;

- TPO, PVC, Polyethylene or Polypropylene, with seams overlapped and fastened by heat weld
- EPDM, with seams overlapped a minimum of 3 inches and glued with adhesive of the type that is impervious to and unaffected by moisture, or it may also be...
- Low profile polypropylene drain board overlapped 3-6 inches and glued with manufacturer-recommended adhesive.

NEVER USE A FUZZY MOISTURE HOLDING FABRIC, SUCH AS NEEDLE PUNCHED POLYETHYLENE OR FELT as a slip sheet/root barrier. This type of fabric stays wet and encourages root growth that could impede drainage. It is also impossible to sweep and keep clean during the installation process. If you become aware that a moisture holding fabric, such as needle punched polyethylene or felt, has been installed by another contractor, stop the process immediately, and have them replace it with the proper material.

proper slip sheet/root barrier materials are durable smooth-surfaced & can easily be swept clean.

improper materials are fuzzy, trap water, and cannot be swept clean during installation.

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# Step B

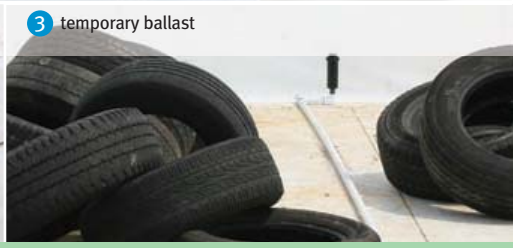
## Job Site Readiness Before Installation

1. Visit the jobsite and the rooftop with a representative from the roofing contractor to get approval for beginning the LiveRoof® installation.

2. At this point, the roof should have been tested, either by flooding or other means, to ensure that it is waterproof. This should come to you with an official written sign-off from the installer of the waterproofing system or general contractor.

3. The protective slip sheet/root barrier and irrigation system (if any) may also be in place and held down with temporary ballast (weight) at this time. Alternatively, you may be responsible to place the protective slip sheet/root barrier. If that is the case, its placement will be done in the near future.





## Step C
### Preparation for Personal Safety and Property Security

Conduct a preinstallation training session with your staff and attend to the following:

1. Give everyone on the installation team a copy of this booklet, LiveRoof® Standardized Procedures and review the installation process.
2. Review all OSHA and related safety procedures. Be diligent with safety harnesses and other special safety equipment for working on rooftops. In many cases you will have to rope off the edges of the roof.
3. Review proper body mechanics and posture for lifting modules. Bend your legs, not your back.
4. Review the importance of protecting the roofing membranes from scratches and punctures. Always report scratches or punctures to the roofing contractor. Never cover up any damage or defect.

1 everyone gets an installation guide


2 review safety and security measures

3 use proper body mechanics

4 protect the roofing membranes, report scratches and punctures

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5. Plan to protect the parapet from bumping and abrasion.

6. If it is your responsibility, properly install the protective slipsheet/root barrier. Ensure that this is preapproved by the manufacturer of the waterproofing system and held down with temporary ballast (weight).

7. Plan for protective sheets of plywood or closed cell foam to further protect the roof surface during installation.

8. Understand that when using lifting equipment, lifting capacity decreases as the boom is extended. Use equipment that is big enough to easily do the job safely.


5 protect the parapet


6 place slip sheet/root barrier & hold with temporary ballast


7 protect roof surfaces from mechanical damage


8 lifting capacity decreases with boom extension

9. Edging is lightweight, plan to hold it in place with temporary ballast as a safety procedure to keep it from blowing off the roof. If the design calls for the edging to be affixed to the slip sheet, it may be done so with a manufacturer-approved adhesive. Edging should never be mechanically attached to the roof surface. One should never penetrate roofing membranes.

10. Never set the Hoppit® directly on the rooftop; instead cushion it with tires or closed cell foam and exert only enough pressure to keep it from twisting.

    *A Hoppit® loaded with 18 standard modules may weigh 1100 pounds. If loaded with 36 modules, it will weigh 2200 pounds, etc. Regardless of what device is used for conveyance, account for its weight as well as the modules.

11. Throughout the installation, constantly sweep up debris and loose growing medium, as it occurs. Do not install modules on top of gravel, debris, etc., as this could damage protective membranes.

12. When plants arrive shrink-wrapped, they will bake in the sun very quickly. Always, get them to the roof right away, unwrap, unload and install them.

13. Avoid walking on plants during installation.

9 edging held in place with temporary ballast

10 plan to cushion Hoppits®

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14. Conveyors can be set on transportable jack-stands. But, these stands must have rubber bases or be set upon plywood to protect the roof membranes, please no sharp edges on roof!

15. Remember that even a flat roof will have enough slope to shed water. If carts are used on the roof, be sure that even when fully loaded they can be easily wheeled about, stopped and braked. Apply brakes or chock the wheels as needed to hold carts in place.

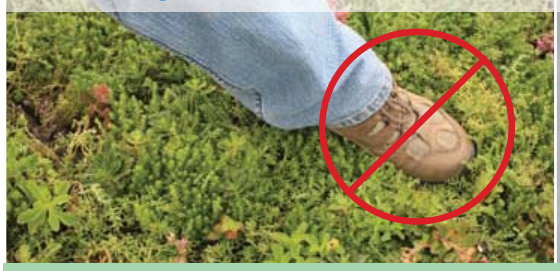
Note: Never work in freezing temperatures and never install frozen LiveRoof modules as frozen soil will prevent the modules from fitting tightly together.

Important: If ever the slightest damage occurs to the underlying roof membrane, stop the process and report it to the roofing contractor for immediate repair. NEVER COVER OVER ANY DAMAGE OR DEFECT. Roof leaks can never be tolerated.

11 sweep up loose soil before placing modules

12 unload Hoppits® quickly to prevent overheating

13 respect the plants and avoid walking on them



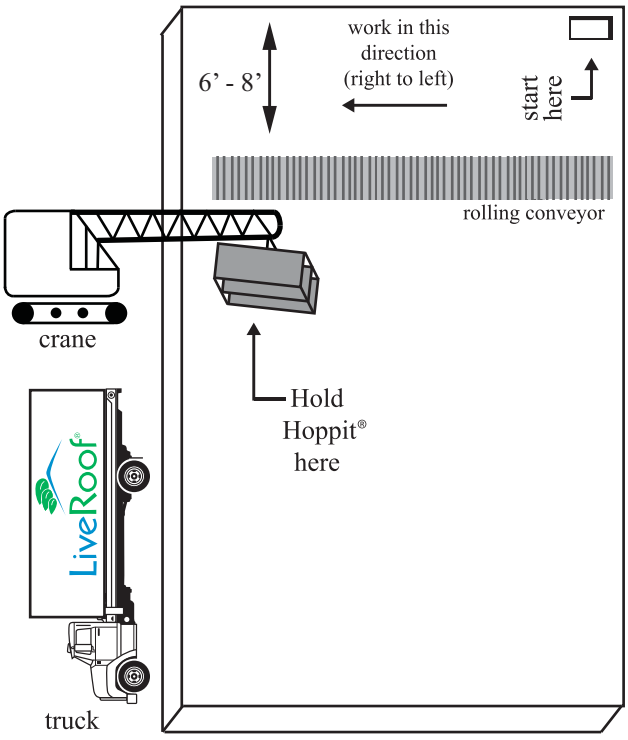
14 only smooth rubber-cushioned equipment on roof

## Step D
### Set Up for Efficient Installation

Plan to Work Smart Not Hard!

1. Decide upon safe and efficient placement of truck and crane.
2. Decide upon efficient rooftop unloading point and placement of conveyors.
3. Establish a point of delivery to roller conveyors and run the roller conveyors parallel to the line of installation. Roller conveyors can be set on transportable jack-stands (with rubber feet) or tires. Conveyors should be set parallel to the line of installation and within 8 to 10 feet of the line of installation. Then, 7 or 8 rows of modules can be set before the conveyor needs to be moved back another 8 to 10 feet.

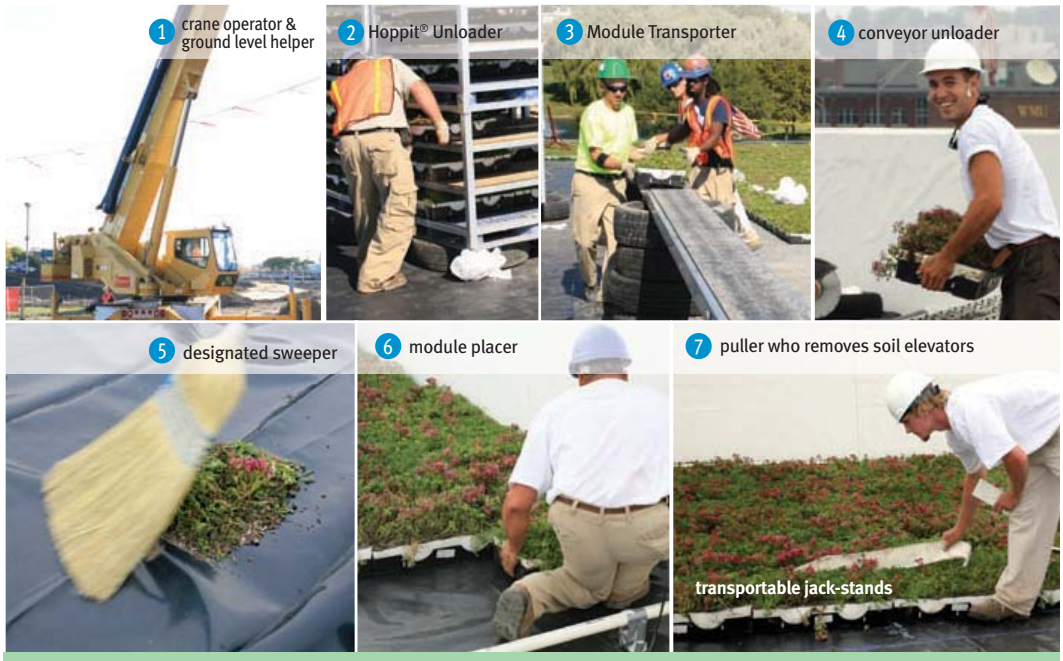
*A well-designed installation will require almost no walking!
If you are walking, you are wasting time and driving up your costs.



**4. Designate the various roles each team member will perform and plan to switch functions every hour or so. Do not multi-task, focus on doing one job right! These roles include:**

1. A crane or lift truck operator and Hoppit® loader at ground level
2. A Hoppit® unloader on the roof top who removes modules from the Hoppit® and places them on the conveyor
3. A module transporter who gently moves modules along conveyor
4. A conveyor unloader on the roof top sets modules on roof surface for module placer.
5. A designated sweeper to keep the roof clean
6. A module placer on the roof top
7. A puller to remove soil elevators

Let everyone know that every time a truck is unloaded, it should be filled back up with empty delivery Hoppits®. Otherwise, additional trips with the truck will have to be made and additional charges will be applied.



# Step E

## Efficiently Conducting a LiveRoof Installation

1. 1-2 days before installation (if not already done by other contractor), install slip-sheet/root barrier as specified, weld, tape or glue all seams, then install irrigation as specified. Use temporary ballast (tires) to hold things in place.

2. Cut and prepare all edging and install pavers that are part of the plan.

   *If edging is left on roof, be sure to secure it with temporary ballast.

3. Set up conveyors parallel to the line of installation as previously determined.

4. YOU WILL USUALLY INSTALL MODULES FROM RIGHT TO LEFT, because of the orientation of the overlapping lip. If you fail to do this, you will not be able to install the modules correctly.

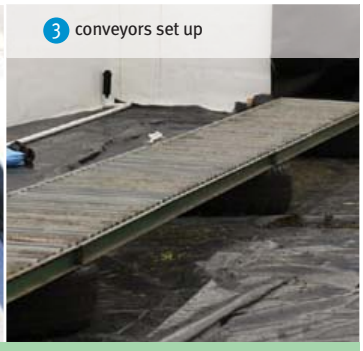
   A. IT IS ALMOST ALWAYS BEST TO START IN A RIGHT HAND CORNER OF THE ROOF, so that the overlapping edges align correctly.

   B. If you have to place modules across long expanses without a hard edge to push against, you may use chalk lines to ensure straight rows.

5. Lift Hoppit® over the parapet and rest lightly upon tires to keep from twisting. Do not rest full weight of Hoppit® on roof.

Another method of transport is to use a crane or forklift to place or suspend the Hoppits™ in the vicinity of where the modules will be installed.





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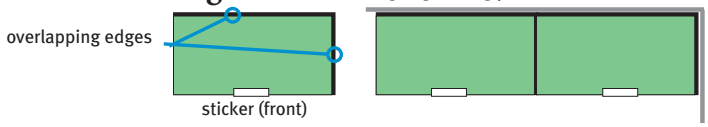
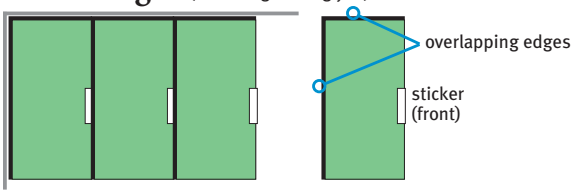
4A Almost always you will work from right to left.

## Right to Left (long edge facing you)




## Left to Right (short edge facing you)

Exception
(for very narrow
installations)




4A work from right to left & overlap edges

4B chalk lines

5 Hoppit® delivered to roof by crane

5 Hoppit® gently rests upon tires

6. Hoppit® unloader removes modules and places them on conveyor. Stickers all facing module placer.

   Notice: When removing LiveRoof® modules, from the Hoppit® or other conveyance device, do not pull on, push against, remove, or otherwise disturb, jar or dislodge the flexible soil elevators. When handling the LiveRoof modules, do so by using the hand grips.

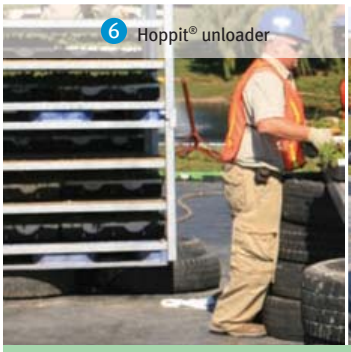
7. Module transporter pushes modules down conveyor line, in a smooth manner so they don't bang together and displace soil.

8. The sweeper must clean the surface before the module placer sets down each module. Avoid setting modules on soil or debris.

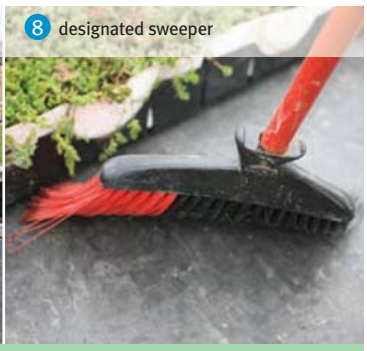
IMPORTANT: Avoid walking on any spilled aggregate or setting modules on top of aggregate. This can damage roofing membranes. During the entire installation the designated sweeper must sweep the roof surface clean and away from the previously placed modules, before placing each new module. Sweep with a corn or kitchen-type broom. Do not use a blower as it will blow gravel under the modules and membranes.

SAFETY: Use proper body mechanics and posture when lifting or setting down LiveRoof® modules. Bend with your knees, not your back and keep the module close to your body.

LiveRoof modules have a front and back side. The front side (the side away from you as you are placing the modules) and the right side have overlapping edges that center the containers and make them align correctly. The orange sticker should face the installer during placement.







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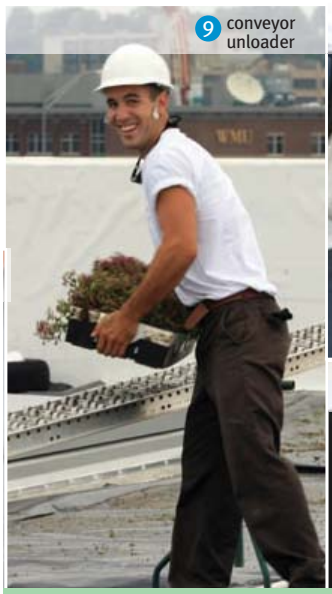
9. Conveyor Unloader removes module from conveyor and sets on roof near module placer with sticker facing out.
10. Once the surface is swept clean the module placer sets down the first module and tightly pushes it in against the edging or parapet with the overlapping lip facing away from him.

IMPORTANT: <u>The sticker must face the Module Placer!</u>

The overlapping lip faces away from the Module Placer!

IMPORTANT: LiveRoof modules have a front and back.

- The overlapping lip is oriented away from the placer.
- The short right side also has an overlapping lip.






11. Set the second module next to it.
    - Make sure its overlapping lip overlaps the half-moon shaped "moisture portal" of the first module.
    - Line them up precisely!
    - Flip any overhanging plant material up and out of the way.
    - Lift and place module snugly in place.
    - Continue to repeat this process until the first row is installed.

      Or, once the first row has 5 to 10 modules placed, another placer may begin the process with the second row.

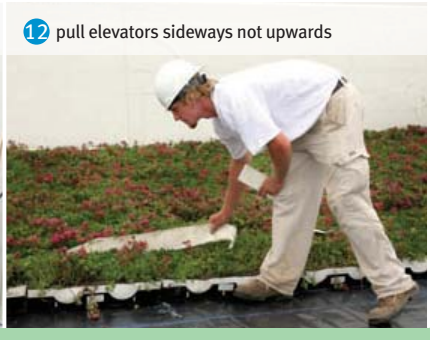
12. REMOVAL OF SOIL ELEVATORS: As the second row is set, the flexible "soil elevators" from the modules in the first row will be 100% surrounded by either modules or edging. AT THIS POINT THEY SHOULD BE PULLED OUT BY THE PULLER.

A good puller can pull 2 adjacent soil elevators out at the same time.

- Soil elevators must be pulled in a sideways fashion not upward (which displaces soil).
- You may want to use a pair of spring loaded pliers.
- Always pull as you go. Don't wait or you will end up trampling the plants and you will overlook many of the soil elevators.
- The puller should bag the soil elevators as he removes them. They should be recycled.

12. The above processes are repeated over and over until all modules are placed.

11 module placer continues to install modules with stickers facing him



12 pull elevators sideways not upwards

## Custom cutting modules to fit odd-sized areas

LiveRoof® modules may be cut, with mature plants and soil in the container, with a radial arm saw with masonry blade much as one would use to cut paver stones. A portable masonry saw also works and a reciprocating saw may be used for curved cuts. Always install modules in a manner that minimizes custom cutting to make installation easier and more cost effective. Always wear protective goggles and gloves.

* Handle gently; the roots will bind the soil, but can be disturbed by rough handling.
* Use a cardboard die or tape measure to transfer your measurements to the person doing the cutting.

IMPORTANT: If the roof is sloping and custom cutting is required, start at the bottom and work up. This way if there is any compression, the compression will be against modules that have not been cut.

When the custom cutting is to be done on a non-draining edge, (top or side of the roof) custom cut modules may be held in place by fitting tightly against either another module or the edging.

In the event of soil infilling between module and parapet or edging, where the gap is 4 inches or less, use filter fabric and LiveRoof® brand engineered green roof soil.

radial arm saw

portable masonry saw

reciprocating saw

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## Step F
### Wrap up and Initial Watering

The job is not finished until all delivery modules are loaded back on the grower's truck. If the driver must wait or return to the job site additional charges will apply.

INITIAL WATERING

Once installed, immediately and completely water plants. Soak the soil from top to bottom; this settles the soil and requires about 1 1/4 gallons of water per module.

SITE CLEANUP

Clean the job site daily and at the end of the job, clean up the job site 100%, leaving no waste or debris.

FINAL SIGN OFF AND MAINTENANCE PROTOCOL

Arrange for final sign-off on the installation. (refer to certified installer training manual.)

Give the owner a copy of the LiveRoof® Maintenance Protocol.

Installation before initial watering

Initial watering

Final sign-off

Dubuque, IA

Grand Rapids, MI

London, Ontario


Muskegon, MI

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