

SECTION 1

The LiveRoof[®] System

LiveRoof is designed to provide **Natural Function** and **Natural Beauty**.

Natural Function

LiveRoof is the only green roof system that uses Soil Elevator™ and Moisture Portal™ technology to unite the entire soil continuum. This allows for the natural sharing of water, nutrients and beneficial organisms across the entire green roof strata. It also minimizes hot, wet, and dry zones, and avoids compartmentalizing the growing medium into unnatural ‘grids’ as is the case with other modular systems. By not compartmentalizing the soil into ‘grids,’ **LiveRoof functions as nature intended**, and the difference in performance is real.



Natural Function

LiveRoof ‘Soil Elevation’ design and Moisture Portals™ unite soil across the entire green roof strata for sharing, not compartmentalization, of water, nutrients and beneficial organisms. This allows the plants to be healthy. Also, hot, dry and wet spots are avoided.

No Photodegradation

To completely prevent photodegradation, LiveRoof[®] modules are subterranean with no exposed lips or edges.

Proper Roof Top Drainage

LiveRoof[®] allows the roof to drain as designed, with drain channels that disperse water at 7.0 gallons per minute per linear foot.

No Air Gaps Between Modules

Uninterrupted continuum of soil eliminates air gaps for optimal R value, cooling value, and stormwater absorption.



LiveRoof[®] modules eliminate air gaps and are protected from harmful UV rays to prevent photodegradation.



Other modular systems may have exposed lips, making them vulnerable to photodegradation and allowing for warm or cool air to escape from the building below.

The aesthetic advantages of LiveRoof are significant, and during spring, summer, fall or winter, **LiveRoof® looks like a beautiful meadow.** Other modular systems may look like man-made ‘grids,’ especially during the dormant season.



LiveRoof® project in June (above) & April (below)



LiveRoof® modules offer meadow-like, natural beauty the entire year, even during winter dormancy.



Other modular system project in June (above) & April (below)



Even if pregrown to full vegetation, other modular systems may look like this during the dormant season.

Natural Beauty

LiveRoof's monolithic soil continuum and unique plant mixtures bring 4-season aesthetics. Soil and plants obscure modules all 12 months of the year.

Subterranean Module

Gives a meadow-like look with no 'grid' lines.

Proven Soil

The industry's best engineered soil, expected to last indefinitely.



LiveRoof® modules can be custom cut to foster creativity.



Other modular systems offer less flexibility.

Flexibility

LiveRoof® modules can be custom cut to create natural looking green roofs with sweeping curves and full vegetation from parapet to parapet. Other modular systems offer considerably less flexibility around drains or edges, and cannot be used on curved applications without creating large gaps.

LiveRoof® is an Instant Green Roof

Each LiveRoof® module arrives to the job site with fully established plants inside the module and is simply set in place on the rooftop. The unique patent-pending Soil Elevators™ are then removed for a seamless fit. There is no need to start with a brown roof and farm it for years, hoping and waiting for it to become a green roof.



Day1: LiveRoof® looks like this



Day1: Conventional / Built in Place systems may look like this and be prone to weed infestation.

LiveRoof® is only sold through licensed Growers with horticultural expertise in your region.

Your local Grower provides plant selection assistance, pricing, technical assistance and training.

Custom equipment, such as Hoppit® racks and Roll-a-Roof™ conveyors are available to allow for fast and safe installations. Check with your Grower to determine if this equipment is currently available locally.

- Unique Hoppits® are custom designed racks which allow the modules to “hop” from the truck to the roof for unloading without double handling.
- Roll-a-Roof™ Conveyor systems are available to minimize unnecessary walking for a faster installation.



LiveRoof® is Unique in that its installers must be prequalified & trained

We care about our customers and always want to ensure things are done right.



SECTION 2

Pre-Bid Considerations

Always check online to ensure you're using the current version of this document:

<http://www.liveroof.com/installation-maintenance>

Retrofit Roofs

- Enlist the services of a structural engineer to determine if sufficient weight bearing capacity exists for the green roof.
- Contact the waterproofing manufacturer to assess the existing waterproofing system and find out whether a green roof retrofit will affect the warranty.
- Visit job site to take exact measurements of the roof for ordering.

Work on your bid several days before it is due and have the following information ready when requesting a quote from your local grower.

- Type and Number of LiveRoof® Vegetated Modules (2 sq ft each).
- Plant mix(es). If more than one mix, how many square feet of each mix?
- Linear feet of LiveRoof® RoofEdge™ (8' lengths), corners, drain boxes, etc.
- Quantity of LiveRoof® engineered green roof soil for infill (if needed).
- Quantity & color of RoofStone® pavers and delivery specifics.
- Anticipated LiveRoof® delivery / installation date.
- Project name, location, and specifying architect.
- Project owner and general contractor.

Be sure to perform your own count of the vegetated roof space for each project. Each project is custom grown, so if the number of modules ordered is too few, additional modules must be ordered and may take two or more months depending on the season to deliver. On the other hand, if too many are ordered, your local Grower typically will not refund the excess.

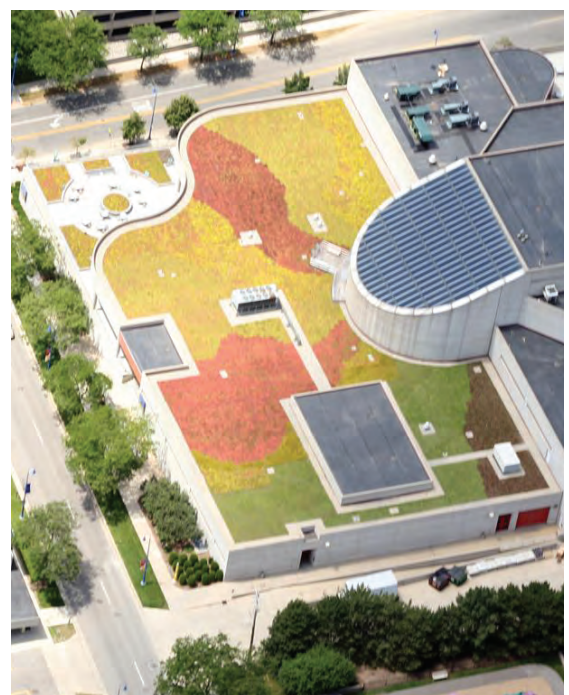
Typical Green Roof Design (below)

A green roof such as this one may be fairly simple to estimate and install, as the roof is designed for minimal custom cutting of the modules and the design calls for a single plant mix.



Complex Green Roof Design (right)

Complex green roof designs may call for curving edges, different plant mixes and many custom cuts. For these jobs, the number of modules will depend on the installer's plan for module placement, cutting, and scrap.



Determine what type of slip sheet, pavers, stone, pedestals, drains, and irrigation will be used and who is responsible for installing them.

Determine how many modules you will install each day and schedule delivery with the grower at least 2 weeks in advance.

Determine the amount of custom cutting or infill (between modules and edging) that will be used. Order enough extra modules, to account for custom cut modules.

Determine who is responsible for maintenance immediately after installation.

Mark-Ups

- Realize LiveRoof® represents the majority of the cost of the green roof (growing medium, drainage, and plants)
- It is a permanent building component not a landscape plant,
- Mark ups on building components are typically 5 % - 10 %,
- You must be efficient with your labor to be competitive and profitable.

Warranties

- Plants: LiveRoof, LLC does not issue plant warranties for any projects not grown by LiveRoof, LLC. Growers may offer a plant warranty but are not required to. Speak with your local grower regarding terms, conditions and pricing of a plant warranty, if applicable. Plant warranties do not exist unless you receive written notification from your local grower.
- Modules: LiveRoof, LLC offers a limited 50 year warranty on properly installed modules which is detailed on the LiveRoof website and in the system catalog. Warranties are issued upon receipt of completed warranty registration form and punch list.
- Overburden Removal: The LiveRoof provided overburden removal warranty is available only from LiveRoof® Diamond Certified Installers (contact your local grower for a list of Diamond Certified Installers). These specially certified installers are authorized to bid on and install LiveRoof systems for projects which are covered by a LiveRoof Overburden Removal Warranty. LiveRoof Overburden Removal Warranties may be purchased for 10, 15, or 20 year terms, and provide coverage for the costs to remove the green roof and replace it after a leak has been serviced. Please contact your local LiveRoof Licensed Grower for details on how to become a Diamond Certified Installer.

SECTION 3

Ordering & Scheduling Shipping (Reference Addendum Sheet)

Become familiar with your local grower's:

- Deposit Terms: What amount is required and when it needs to be received.
- Growing Season: What month your project needs to start growing to ensure timely delivery.
- Shipping Methods: Does the grower have retractable trailers and engineered hoppers.
- Credit Terms: What paperwork needs to be filled out, and what are the standard terms and payment methods.

Schedule shipping with your grower 2-4 weeks in advance. Organize details such as

- Delivery time, location, and foreman's contact information
- Safety requirements on site
- Loading of plant mixes in order of installation on trucks

SECTION 4

Preparation Before Installation

The Week Before Installation

- Visit the job site with a representative of the roofing contractor for approval to begin LiveRoof installation. At this point, the roof should have been waterproof tested and signed off as ready for the green roof by the roofing contractor. LiveRoof, LLC recommends that a 24 to 48 hour flood test be performed.
- Request a visit from your local LiveRoof representative to discuss logistics if needed. This request should be made 2 weeks in advance to ensure travel arrangements can be made.
- Arrange for pick-up of the Roll-A-Roof conveyor system (if available from local grower).
- A representative of your local grower will contact the job site foreman 2-3 days before an installation to conduct a pre-installation review of the critical aspects of the installation.
- Depending on the project size and your level of experience, a representative of your local grower will be on site during the first few hours of an installation to ensure standardized installation procedures are understood and followed. Grower observation does not waive installer of its contract responsibilities or workmanship warranties to the owner.

The Day Before Installation

- Install Slip Sheet

It must be seam welded, glued, or taped, according to the manufacturer's directions. Welding or gluing the seams is essential to keeping aggregate and roots from getting under the slip sheet.

Follow the architect's specifications. You may be held liable for unauthorized substitutions or changes.

Slip sheet must be pre-approved by the manufacturer of the waterproofing membrane, and you should ensure that the warranty for the waterproofing membrane remains intact. Usually it will be one of the membrane manufacturer's own products, typically one of the following, no less than 40 mil. thick:

Welded Seam Type	TPO, PVC, HDPE, Polypropylene, with seams heat welded
Glued Seam Type	EPDM, with seams overlapped 3-6 inches, primed and glued or with double-sided manufacturer-approved tape.
Low profile drain board	Overlapped 3-6 inches and glued with manufacturer-recommended adhesive.

NEVER use duct tape or any non-approved adhesive.

NEVER use a moisture holding fabric, such as needle-punched polyethylene or felt. These materials stay wet and encourage root growth that could impede drainage, they are also impossible to sweep clean during installation.

Inverted roofs are inherently protected by insulation and a filter fabric is considered an appropriate slip sheet.

- Place Edging

Cut and prepare all edging. When cutting and bending edging, make sure to do so on a protected surface and not directly on the waterproofing membrane. Note: it is best to score the top back portion of the edging prior to bending. RoofEdge™ pre-bent corners are also available.

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



- Lay Out Pavers

RoofStone Co-engineered Pavers

Coordinate the sequence in which you would like your pavers and modules to arrive.

RoofStone Pavers do not require edging or pedestals. They have a solid 4" side which acts as edging, and have built-in drainage.

RoofStone will follow the contours of the roof, just as the LiveRoof module. Shims are provided (one for every 4 pavers) for occasional minimal adjustments.

RoofStone pavers will install in about 1/10 of the time required for conventional pedestal pavers.

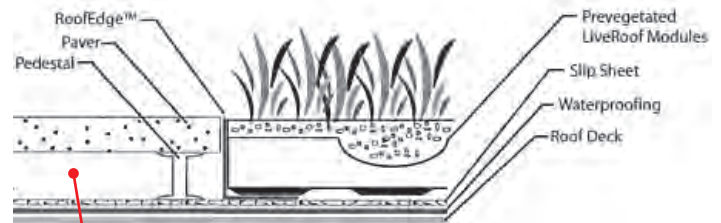


RoofStone paver is fully integrated and requires no edging.

Conventional Pavers (more complicated and costly).

Remember to allow drainage under your pavers, this can be accomplished by laying a low profile drain board beneath the pavers or by using a pedestal system.

Standard Pavers require edging to prevent soil erosion.



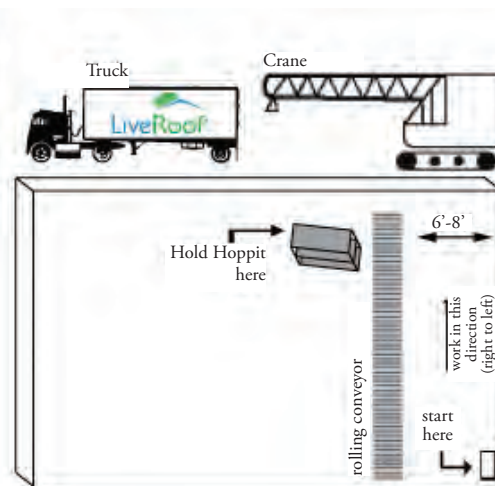
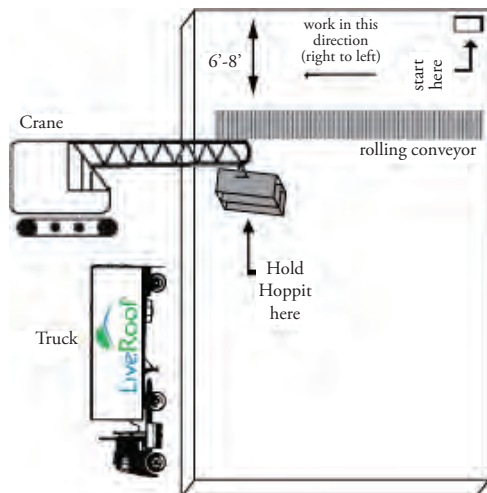
Conventional paver requires pedestals and edging.

- Review Installation DVD with Crew

The Day Of Installation

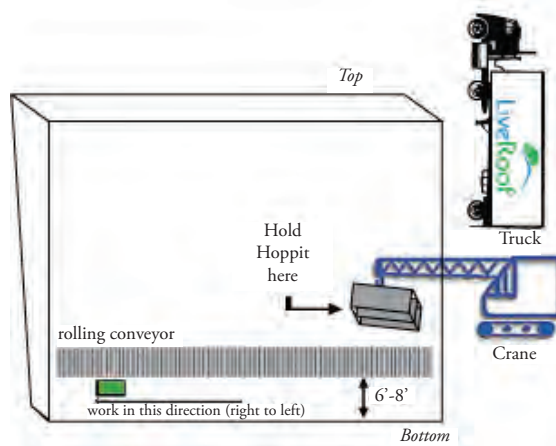
- Use Materials Check List to prepare for each job
- Review OSHA regulations; be diligent with harnesses and other special safety equipment. You may even have to rope off the edges of the roof.
- Plan for Set-Up of Truck & Crane

FLAT ROOFS



SLOPED ROOF

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



Roofing carts can also be used to transport modules rather than the rolling conveyor system.

- **Set-Up Conveyor**
 - Decide upon efficient rooftop unloading point and placement of conveyors.
 - Orient conveyor line 6-8 feet away from and parallel to the roof edge where modules will be placed.
 - This way, 4 to 6 rows of modules can be set before the conveyor needs to be moved back another 6-8 feet.
 - A well designed installation will require almost no walking! **WALKING IS WASTE**
- Roller conveyors can be set on transportable jack-stands. But, these stands must have rubber bases or be set upon plywood to protect the waterproofing. Use a LiveRoof® Roll-a-Roof™ conveyor if available.
- **Lay Out Patterns**
 - Use orange spray paint to roughly lay out any designs on the slip sheet. This will give the crew a visual as to where they should switch mixes.



A well prepared roof, ready for the delivery of LiveRoof modules. The slip sheet is properly installed, the pavers are laid and cut, and edging is installed and ballasted.

SECTION 5

Trucks & Rigging

Many LiveRoof growers ship their modules on retractable top trailers.

- Check with your local grower to see if LiveRoof drivers are able to perform the rigging of our shipping racks for you.
- Each time a truck is unloaded, fill it back up with empty Hoppits. If a truck returns to the nursery empty, there will be additional charges from the grower.
- Trucks are scheduled to be at your site for no more than 4 hours. Any additional time will result in additional charges.

LiveRoof modules are shipped on racks called Hoppits.

- Each Hoppit holds 36 standard modules, and weighs 2,300 lbs.
- Regardless of what device is used for conveyance, account for the weight of the Hoppit as well as the modules.
- If needed you can request that a spreader beam is sent on your truck, allowing you to lift two Hoppits at once.
- Never set the Hoppit directly on the rooftop without protecting the waterproofing and ensuring that the roofing capacity will hold the Hoppit; cushion it with plywood or closed cell foam and exert only enough pressure to keep it from twisting.
- Be absolutely sure to place the Hoppit® or other conveyance device on the roof, only in areas of adequate support for the weight, and only after placing appropriate protective materials on top of the roof membranes.

Hoppits can be brought to the roof via crane or fork lift.

- When using lifting equipment, lifting capacity decreases as the boom is extended. Use equipment that is big enough to easily do the job safely.
- If using Hoppit®, lift by forks under pallet base or by lifting ring using crane hook only. **NEVER lift the lifting ring using fork lift arm or any other non-secured method. The Hoppit® could slide off the fork and cause damage or injury.**
- Always protect the parapet (wall around roof) from bumping and abrasion.
- With appropriate sized crane you can lift one or two 36-module Hoppits. Know the capacity of your equipment.

SECTION 6

Efficient Module Placement

Plan to Work Smart, not Hard!

With your Staff, Conduct a pre-installation meeting with installation crew to review set up and efficiency including the following:

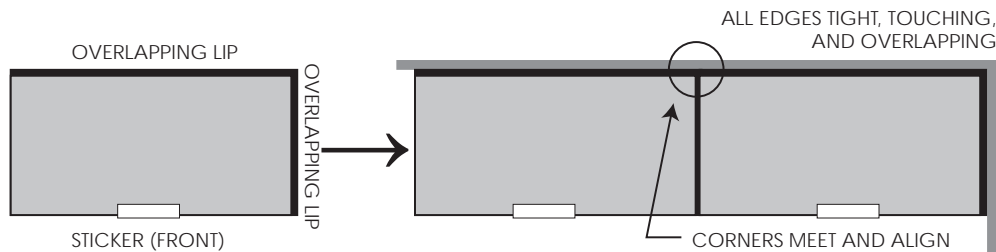
Start in the top right hand corner of the roof.

Use proper body mechanics and posture when lifting LiveRoof modules. Bend your legs, not your back and hold modules close to your body.

If 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. Don't let them cook in the sun.

Avoid walking on plants during installation.

YOU MUST ALWAYS WORK FROM RIGHT TO LEFT SO THAT THE OVERLAPPING LIPS ALIGN CORRECTLY.



Module corners and sides need to align correctly to ensure soil is not spilling between trays and possibly impeding drainage.

If not placing modules against a wall, pavers, or edging, make chalk lines to indicate direction and to ensure straight rows. Don't compose as you go, plan ahead.

Establish a team of 6 or 7 people and designate the specific function that each person will perform. Plan to rotate functions each hour or two to eliminate fatigue. An efficiently conducted installation on a 3 story building, with 6 or 7 people using the Roll-a-roof conveyor can install 6,000 square feet per day.

	LiveRoof Truck Driver*	Attaches crane hooks onto Hoppits
1	Hoppit Unloader**	Directs crane operator with 2-way radio and removes modules from Hoppits and places them on roller conveyor
2	Module Transporter**	Pushes modules along Conveyor
3	Conveyor Unloader**	Sets modules within reach of Module Placer
4	Sweeper	Uses kitchen broom to keep surface clean before modules are placed
5	Module Placer	Sets modules in place on roof surface
6	Soil Elevator™ Puller	Removes soil elevators, bags them, and sends them down to ground for recycling
7	Custom Cutter	(optional)

* Check with your grower to see if the LiveRoof truck drivers may assist by attaching the Hoppits to the crane. Efficiently executed installations should take 2 1/2 to 3 hours per truckload. **The installer may be charged up to \$100 per hour or fraction thereof if the driver is kept onsite longer than 4 hours per truckload.**

** **If no conveyor is used, people 1,2, and 3 carry modules from the Hoppit to the area of placement.**

Hoppit Unloader

- Within a few feet and alongside the conveyor, rest the Hoppit lightly upon closed cell foam or roofing cart to protect roof, and to prevent Hoppit from twisting. Do not place the full weight of the Hoppit on the roof deck.
- Alternatively: use a crane to suspend module-filled Hoppits in the vicinity of where the modules will be installed.
- Do not overload the capacity of the roof, and protect the roof surfaces with plywood, or closed cell foam.
- Use hand grips on the bottom of the tray, and never pull on the removable soil elevators.
- Then place modules on conveyor, all in the same direction with stickers facing toward the module placer.

Module Transporter

- Pushes modules down conveyor line, in a smooth manner so they don't bang together and displace soil.
- Moves modules from Hoppit to the area where the module placer is putting modules down.

Conveyor Unloader

- Takes modules off of conveyor and places them near the module placer.
- If conveyor is not being used, this person can help the module transporter.

Sweeper

- The sweeper must clean the slip sheet surface before the module placer sets down each module. Avoid setting modules on soil or debris.
- It is best for the sweeper to follow behind the soil elevator remover as this process creates the most debris.

Module Placer

- LiveRoof modules have a front and back.
The overlapping lip is oriented away from the module placer.
The short right side also has an overlapping lip.
- 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. **Only push against the hard plastic base of the module.**
- Set the second module next to it.
Make sure its overlapping lip overlaps the half-moon shaped "moisture portal" of the first module.
Flip any overhanging plant material up and out of the way.
Push module tightly in place.
The corners of the modules must align precisely with the adjacent modules. If the modules become misaligned, stop the process immediately and correct the alignment.



IMPROPERLY ALIGNED MODULES.

Always ensure the corners of each module line up with the corners of adjacent modules. Failure to do so can lower product performance.

All sides of the modules must be tight, touching and overlapping all adjacent modules.

- 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.

Soil Elevator Remover



- 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, the soil elevators should be pulled out.**
- A good puller can pull 2 adjacent soil elevators out at the same time.
- Soil elevators must be pulled in sideways fashion, not upward (which displaces soil).
- Use a pair of spring loaded pliers for pulling.
- Soil elevators should always be pulled 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.
- It is helpful to pull elevators out half way as a marker whenever you take a break or step away from where you left off.

Custom Cutter

- LiveRoof modules may be cut to size, with plants and soil intact, using a masonry saw or similar tool.
A reciprocating saw can also be used and can be used for curved cuts.
Always install modules in a manner that minimizes custom cutting.
Wear protective goggles and gloves.



CUSTOM CUTTING METHOD

Mark cut line using a straight edge and grease pencil.

Handle gently to keep soil intact.

Set module on table or elevated surface during cutting - a table made from a minimum 4” insulation works well with reciprocating saw.

Never cut module while it is on membrane or roof deck.

- Orient the cut side against another module if it's on the low, draining side, of the roof.
- **If the roof is sloping, start at the bottom and work up.** This way if there is any compression it will be against modules that have not been cut.
- In the event of infilling gaps that are less than 4 inches wide, use only LiveRoof brand engineered green roof soil and keep it in place with filter cloth.

SECTION 7

Common Mistakes – What NOT To Do

Edging needs to be used in all applications where parapet or paver is of insufficient height / thickness to fully contain the soil above the edge of the plastic tray. This will prevent soil from spilling out of the tray, washing into your drainage channels and impeding proper drainage.



Edging must be used where pavers or parapet do not contain entire exposed soil level. Failure to use edging can lead to soil washout & expose the module to photodegradation.

NOTE: RoofStone® pavers do not require edging if bordered by LiveRoof® modules or parapet.

Edging must be perforated to allow drainage. If edging does not allow for drainage water will pond on the roof under the modules and can cause root rot which will result in plant die off.



Pull the soil elevators while standing on the slip sheet. NEVER stand on the plants to pull soil elevators; you can trample the plants if you do so.



DO NOT STAND ON THE PLANTS TO PULL SOIL ELEVATORS. This may cause plant damage.

NEVER move plants from a thawed to a frozen environment. And, never move frozen plants to a warm environment. Rapid exposure to freezing or thawing temperatures may kill plants.

Never install frozen LiveRoof modules. They will not align properly and fit tightly.

If even the slightest damage occurs to the underlying roof membrane, stop and report it to the roofing contractor for immediate repair. NEVER COVER ANY DAMAGE OR DEFECT. Report damage from other contractors as well.

SECTION 8

Wrap Up and Initial Watering

Clean up the job site 100%; leave no waste, debris or excess modules.

Once installed, immediately and completely water in plants. Soak the growing medium from top to bottom. This settles the growing medium, and requires about 1 ¼ gallons of water per module. Look for water flowing freely to roof drains to indicate that you have watered thoroughly. For maximum efficiency on large projects set up sprinklers on completed sections while working on other areas of the roof.

SECTION 9

Transfer of Ownership

NOTE: As the installer, you are responsible for maintaining the green roof until the maintenance contractor accepts responsibility or an owner's representative accepts the green roof installation as correctly executed and complete.

Follow the LiveRoof® Maintenance Protocol, printed copies are available from your local grower or you may download the protocol from the www.liveroof.com. In the event that you are not hired to maintain the green roof, ensure the owner or maintenance contractor has a copy of the LiveRoof® Maintenance Protocol.

SECTION 10

Moving Previously Installed Modules

With a dull flat bladed spade, probe the growing medium for a container edge.

With a dull instrument, such as the handle of a spoon, butter knife or trowel, dig back a few plants and expose the container edge (never cut or damage roof membranes).

Then, with the same dull instrument, cut along all four sides of one module.

Using a pair of pliers, grasp the lip of the container and lift it to expose the roof surface.

Successive modules may be removed in similar fashion.

Sweep up all aggregate before replacing modules.

Replace the modules by simply setting them back on the roof surface with the overhanging lip orientated in the same manner as the installed modules.

SECTION 11

Final Sign Off and Warranty Registration

The installer should have the owner or owner's representative sign off on the project. At the same time the installer's representative should sign off that the LiveRoof Standardized Procedures were followed on the **warranty registration form** and **punch list**. Warranty forms provided by licensed LiveRoof® growers.



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