

MULE-HIDE LIVING ROOF™ SYSTEMS

Mule-Hide Roofing Systems for Use with GreenGrid® Vegetative Roof Systems

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MULE-HIDE LIVING ROOF™ SYSTEMS

Mule-Hide Roofing Systems for Use with GreenGrid® Vegetative Roof System

Part 1 **General**

1.01 **Description**

- A. The Mule-Hide Living Roof™ System will utilize one of the following membranes:
- Mule-Hide Standard (non-reinforced) or FR Black EPDM Membranes
 - Mule-Hide Standard or FR Reinforced Black EPDM Membranes
 - Mule-Hide TPO Membrane
 - Mule-Hide FleeceBack TPO Membrane
- B. The membranes may be fully adhered, mechanically attached or loose-laid over an approved substrate. The method of attachment of the membrane and the thickness of the membrane used is dependent upon the deck type, load and uplift design requirements for the specific building as well as local code requirements and warranty selected.
- C. The GreenGrid® modules shall include growth media and vegetation as specified on drawings or as directed by the Project Engineer. Plant selection is dependent on the climatic region of the project.
- D. Other components including, but not limited to, protection fabric, pavers or walkway material, membrane protection material, drainage stone/ballast, Ecoballast®, edge/border treatments, water features and irrigation systems are installed above the roof membrane depending on allowable loads.
- E. The work shall include, but is not limited to, the installation of the roof system, unloading, hoisting and installation of the GreenGrid modules and protection fabric, installation of edge treatments, rubber pavers, decorative ballast, and an irrigation system, if specified.
- F. Garden/Vegetated Roof Categories
1. Extensive

Extensive Green Roof Systems are functional green roofs that include between 2 to 6 inches of an engineered growth media (primarily inorganic substrate) and appropriate plant species. Extensive systems generally weigh between 10 and 25 lbs per sf saturated. Plant mixes are generally composed of highly drought resistant groundcovers that can thrive in a non-irrigated (climate dependent), rooftop environment in the given project location. Extensive mixes (hardiness zone dependent) generally include species of *Sedum*, *Delosperma*, and other drought resistant perennials with the goal of minimizing long-term maintenance and fertilization; but keep in mind it will never be maintenance free.
 2. Intensive

Intensive Green Roof Systems are rooftop gardens composed of much deeper engineered growth media depths (more organic substrate) and appropriate plant species. Due to the fact of more organic material in the blend and greater depths, the Intensive systems generally weigh between 25 and 200 lbs per sf. saturated. Plant selection may include varieties of ornamental and/or native: groundcovers, grasses, perennials, and in some instances trees and shrubs. Depending on the plant selection, an irrigation system is generally needed and since these rooftop gardens are similar to a garden in your backyard, they will require varying degrees of long-term maintenance and care.

1.02 Design Guidelines

- A. The Mule-Hide Living Roof System shall incorporate EPDM Membranes 45-mil or 60-mil thick or TPO membranes 45-mil and 60-mil thick for 10 and 15 year system warranties.
- B. The Mule-Hide Living Roof System shall incorporate EPDM membranes 60-mil or 90-mil thick or TPO membranes 60 or 80-mil thick for 20-year system warranties.
- C. EPDM or TPO membranes may be installed loose-laid over an approved substrate provided the GreenGrid modules meet the recommended minimum weight required by the building code uplift requirements (equivalent to a ballasted roof system). A minimum 1/2-inch thick approved cover board (Dens-Deck Prime or Securock) is required (loose laid) over the insulation. The roof membrane must be temporarily ballasted until the GreenGrid modules are installed. A protection fabric of a minimum of 6oz/yd² shall be installed over the membrane prior to the installation of the GreenGrid modules. The loose laid system shall only be used in non-hurricane wind zones where winds do not exceed 90 mph as defined by ASCE 7 (latest edition). See Mule-Hide Living Roof System Attachment I.
- D. EPDM Standard Reinforced and FR Reinforced membranes may be installed mechanically attached over an approved substrate provided the membrane is attached in compliance with local building code uplift requirements. A protection fabric of a minimum of 12oz/yd² shall be installed over the membrane prior to the installation of the GreenGrid modules. See Mule-Hide Living Roof System Attachment II.
- E. EPDM membranes may be installed fully adhered over an approved substrate provided the membrane and substrate are attached in compliance with local building code uplift requirements. A protection fabric of a minimum of 6oz/yd² shall be installed over the membrane prior to the installation of the GreenGrid modules. See Mule-Hide Living Roof System Attachment III.
- F. TPO membranes may be installed mechanically attached over an approved substrate provided the membrane is attached in compliance with local building code uplift requirements. A protection fabric of a minimum of 12oz/yd² shall be installed over the membrane prior to the installation of the GreenGrid modules. See Mule-Hide Living Roof System Attachment II.
- G. TPO membranes and TPO Fleece Back membranes may be installed fully adhered over an approved substrate provided the membrane and substrate are attached in compliance with local building code uplift requirements. A protection fabric of a minimum of 6oz/yd² shall be installed over the membrane prior to the installation of the GreenGrid modules. See Mule-Hide Living Roof System Attachment III.
- H. Seaming of the TPO membrane is achieved with a minimum 1-1/2" wide hot air weld. All TPO field seams shall be covered with either the 6" wide TPO Reinforced Flashing Strips welded in place or covered with 6" wide TPO Cover Tape (Tape Primer must be used). Refer to Mule-Hide Living Roof System Attachments I, II and III for options.
- I. EPDM membranes are seamed together using either 3" wide or 6" wide In-Seam-Tape. Mule-Hide Tape Primer must be used to prep the seams before applying the In-Seam Tape. All field seams shall be covered with 6" wide Cured Cover Tape. Use of Splice Adhesive is not permitted.
- I. For fully adhered and mechanically attached roof systems, insulation attachment is recommended with the use of adhesive (approved low-rise foam) or approved fasteners depending on the deck type. Cover board attachment is recommended with the use of an approved low-rise foam adhesive. For optional methods of attachment refer to the Mule-Hide Living Roof System Attachments I, II and III.
- J. It is the responsibility of the Building Owner/Owner's representative (architect or structural engineer) to confirm the roof deck will support the weight of the saturated GreenGrid modules and any other live or construction loads.
- K. A minimum roof slope of 1/4" per foot (1/4:12) should be provided to ensure proper drainage. The GreenGrid modules should not be installed on slopes greater than 1-1/2" per foot (1-1/2:12) without proper engineering to secure the modules and growing media in place. Do not install the GreenGrid

modules in areas where ponding occurs. The ponding condition must be corrected prior to installing the GreenGrid modules.

1.03 Quality Assurance

- A. If a System (Labor and Material) Warranty is requested, a Mule-Hide Warranty Eligible Contractor must install the Mule-Hide Living Roof system. The Mule-Hide roofing membrane system shall be installed in strict compliance with Mule-Hide's published specifications and details. Deviations must be approved by Mule-Hide prior to the installation of the roofing system.
- B. A pre-installation meeting should be coordinated by the Architect/Specifier/Building Owner's representative. Included in attendance should be the roofing contractor, membrane manufacturer's representative, project supervisor/GC and other trades working on the roofing system both before and after the roofing system is completed. The purpose of this meeting is to review the phases of installation, make sure all trades involved are working together and have resolved any conflicts, make sure all parties involved understand the necessity to protect the roofing membrane until the Mule-Hide Living Roof is completed.
- C. Upon request by the Mule-Hide Warranty Eligible Contractor, an inspection of the roof waterproofing system will be conducted by a Mule-Hide Representative to ascertain that the roof waterproofing system has been installed in compliance with the Mule-Hide specifications and details. This inspection shall be performed after completion of the roof waterproofing system but prior to the installation of the GreenGrid modules and other "above roof" components. The Mule-Hide Warranty Eligible Contractor must notify Mule-Hide at least 2 –3 weeks in advance for scheduling of the inspection of the completed roof waterproofing system.
- D. All items listed in the inspection punch list shall be completed prior to installing the protection fabric and GreenGrid modules. A reinspection may be required to confirm all punch list items have been completed.
- E. Flood testing, electronic testing or other methods of leak detection is strongly recommended to check the waterproof integrity of the waterproofing membrane prior to installing the GreenGrid modules and other "above roof" components.
- F. Additional inspections may be scheduled by the Mule-Hide representative to ensure proper protection of the roofing membrane system is being addressed to prevent possible damage to the roofing membrane during the installation of the GreenGrid modules and other "above roof" components.

1.04 Submittals

- A. For all Projects, to ensure compliance with Mule-Hide's specifications and details, a Mule-Hide Warranty Application and Pre-Job Survey Form shall be submitted to Mule-Hide for review prior to installation.
- B. A dimensioned roof drawing showing sheet layout and GreenGrid module locations (if only portions of the roof are being covered) and slope shall be submitted to Mule-Hide with the Mule-Hide Warranty Application. A GreenGrid Survey Form must be completed and submitted with the Warranty Application.
- C. The contractor shall submit an installation plan including but not limited to: waterproofing quality control, system delivery, and maintenance plan until green roof acceptance.
- D. Provide a detailed water hook-up plan if an irrigation system is required on the drawings.

1.05 Warranty

- A. 10, 15 or 20-year System Warranties are available for a charge on commercial buildings only. System warranties are not available on residential projects. The warranty applies only to Mule-Hide labeled or approved products.

- B. The System (Standard or Premium) Warranty covers the roof waterproofing system and is defined as the roofing membrane, flashings, adhesives, sealants and other Mule-Hide labeled products utilized in the roof waterproofing system.
- C. GreenGrid Material warranty - a material warranty is available for the GreenGrid modules that warrants each GreenGrid® Module (the "Product") will perform its function of containing plant growth media for a period of twenty (20) years from the date of shipment of the Product by Mule-Hide. As used herein, "Product" means only the module and excludes (i) any plants, growth media, and any other materials placed within the GreenGrid modules, or (ii) any irrigation, mechanical, structural, or electrical components contained therein or attached thereto.
- D. In the event warranty service is required, it is the building owner's responsibility to expose the waterproofing membrane assembly in the areas where leaks are occurring and then recover the area once repairs are completed.
- E. Mule-Hide offers a Wrap-Around Warranty for a fee that covers the removal and repositioning of the GreenGrid modules, walkway pads, pavers and ballast in areas where warranted repairs are required. Removal and repositioning of overburden other than listed herein is the responsibility of the building owner.
- F. Standard 30 Day Plant Limited Warranty: Mule-Hide will supply replacement plant(s) free of charge for any plant found to be dead or in severe decline (beyond the point of returning to aesthetic and economic value as determined by a representative of Mule-Hide) for a period of 30 Days from the date of shipment of the Product by Mule-Hide. This warranty covers only those plant (specie) selections offered or approved by Mule-Hide. Those NOT approved but planted to meet a design requirement shall not be covered. This warranty is NOT in effect for plant material purchased and installed outside the recommended installation season (Installation Season: April 15th through October 15th) or plants purchased and installed by others. **The contractor and/or the building owner must follow and document the 30-Day Maintenance Schedule Requirements to maintain the 30-day Plant Warranty. Refer to Section 3.07.**
- G. The formation or presence of mold or fungi in a building is dependent upon a broad range of factors including, but not limited to, the presence of spores and nutrient sources, moisture, temperatures, climatic conditions, relative humidity and heating/ventilating systems and their maintenance and operating capabilities. These factors are beyond the control of Mule-Hide and Mule-Hide shall not be responsible for any claims, repairs, restoration or damages relating to the presence of any irritants, contaminants, vapors, fumes, molds, fungi, bacteria, spores, mycotoxins, or the like in any building or in the air, land or water serving the building.

1.06 Job Conditions

- A. Mule-Hide roofing materials may be installed in temperatures below 40° F but only after consultation with the Mule-Hide Customer Service Department as special precautions or procedures may be necessary. The performance of the materials, installation costs and production rates may be affected.
- B. Only as much new roofing as can be made watertight each day shall be installed each day. This includes all flashing work.
- C. All substrates to receive new insulation, membrane or flashing shall be thoroughly dry. Should surface moisture occur, the contractor shall provide adequate equipment to dry the substrate prior to application of new materials.
- D. Prior to and during application, all dirt, debris and dust shall be removed from surfaces to be roofed for both new and reroofing substrates.
- E. Precautions shall be taken to prevent wind blow-off or wind damage during the course of the roofing application. This may necessitate additional securement of temporary construction, materials and equipment.

- F. The contractor shall verify and ensure that all roof drain lines are unblocked before starting work. Any blockages found shall be reported to the owner's representative and Mule-Hide's Warranty Department in writing.
- G. Temporary waterstops shall be installed at the end of each day's work. Temporary waterstops shall be removed at the start of the next day's work and properly disposed. Waterstops shall be compatible with all materials.
- H. Do not allow contaminants such as petroleum, acid, solvents, etc. or direct steam venting to come into direct contact with the Mule-Hide Roofing Membrane. Contact the Mule-Hide Customer Service Department for recommendations if such conditions exist.
- I. Do not install the Mule-Hide Roofing Membrane in direct contact with any product containing coal tar pitch, creosote or penta-based materials. Consult the Mule-Hide Customer Service Department for special installation requirements.
- J. The contractor shall follow and comply with all safety regulations as recommended by OSHA.
- K. All work shall be scheduled and executed without exposing interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.
- L. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surfaces and equipment movement. Contractor shall provide all necessary protection and barriers to segregate the work areas and prevent damage to adjacent areas. If excessive traffic over newly installed membrane is necessary, contractor shall provide plywood, wood fiberboard or polyester felt protection to prevent damage. All damaged material shall be replaced with new materials.
- M. All existing roofing materials to be removed for construction shall be immediately removed from the construction site to a dumping area authorized to receive such debris. Any hazardous materials such as asbestos or materials containing asbestos fibers shall be removed and disposed of in accordance with applicable City, State and Federal requirements.
- N. Any unusual or concealed conditions discovered during the course of the work are to be reported to the owner and Mule-Hide immediately in writing. Work is to be halted until the owner has responded with a solution to the problems.
- O. All local building codes and requirements must be followed where applicable. It is the roofing contractor's sole responsibility to determine and ensure that the roofing system selected complies with all local codes and requirements.
- P. Both interior and exterior building areas affected by construction shall be cleaned up and any damaged areas shall be repaired to the owner's satisfaction.
- Q. When using heat-welding equipment, always review the equipment manufacturer's instructions, precautions and warnings.
- R. Heavily traveled areas must be protected by placing temporary protection courses to prevent damage to the membrane. Coordination between various trades to avoid unnecessary rooftop traffic and prevent damage to the roof membrane is essential.

1.07 Product Delivery, Storage and Handling

- A. All products delivered to the job site shall be in their original unopened containers or wrappings and clearly labeled with the manufacturer's name, product identification and date of manufacture.
- B. Protect all materials from damage during transit, storage and delivery to the job site. Place all materials on pallets and protect from moisture.

- C. Store all materials in a dry, clean area protected from the elements. All rolls of membrane shall be stored flat on pallets.
- D. All adhesive and caulking shall be stored at temperatures between 60°F and 80°F.
- E. All flammable materials shall be stored in a cool, dry area away from open flames and sparks. Follow precautions outlined on containers or supplied by the material manufacturer/supplier.
- F. All materials determined as being damaged (confirmed by Mule-Hide) due to improper storage on the job site are to be replaced with new materials.
- G. Liquid adhesives and sealants exposed to lower temperatures should be restored to a minimum of 60°F (16°C) before use.
- H. Refer to the applicable Material Safety Data Sheets and product Data Sheets for cautions, warnings and other information.
- I. GreenGrid Installation Season:
 - 1. Northern Climates: Unless otherwise permitted, module installation shall be done between April 15 and October 15, but not when the weather is below 50° F.
 - 2. Southern Climates: Will be dependent upon weather and/or plant availability
- J. Do not install on saturated roof surfaces or under freezing weather conditions.
- K. Coordinate the completion of installation within a 24-hour period from the time the modules are to be delivered.
- L. Handle planted modules with care. Do not drop, kick, or point-load modules during handling and installation.

PART 2 PRODUCTS

2.01 General

The membranes and accessories comprising this roof waterproofing system are to be products labeled, or approved by Mule-Hide. The installation, performance or integrity of products by others is not the responsibility of Mule-Hide and is expressly disclaimed by the Mule-Hide Warranty.

2.02 Membranes

- A. Mule-Hide Standard Black and FR EPDM membranes (non-reinforced), Standard and FR Reinforced EPDM membranes or Mule-Hide TPO membranes may be used with this system.
- B. Refer to paragraph 1.02 Design Guidelines for required membrane thickness that is dependent on the warranty requested and the methods of attachment.

2.03 Related Mule-Hide Materials

- A. Accessories for use with the Mule-Hide black EPDM membranes - Bonding Adhesive (solvent-based), Acrylic Water Base Bonding Adhesive, Tape Primer, In-Seam Tape, Uncured Flashing Tape, Cured Cover Tape, RMS Strips, Lap Sealant, Water Cut-Off, Pourable Sealer, Pre-Cut Inside/Outside Corners, Pre-Molded Pipe Boots, Pourable Sealer Pockets, All Purpose Bar, Mule-Hide Fasteners, Mule-Hide Seam and Insulation Plates.

- B. Accessories for use with the Mule-Hide TPO Membranes - TPO Bonding Adhesive (Solvent based), WBBA Bonding Adhesive (water based), RUSS Strips, TPO Reinforced Flashing Strips, Non-Reinforced TPO Flashing, TPO Fabricated Flashings (Molded Pipe Seals, Universal Corners, Split Pipe Boots, Curb Wrap Corners), TPO Coated Metal, Weathered Membrane Cleaner, Tape Primer, TPO Cover Tape, Uncured White Flashing Tape, All-Purpose Bar, Mule-Hide Fasteners, Mule-Hide Seam and Insulation Plates, Thermoplastic One-Part Pourable Sealant, Cut Edge Sealant.
- C. Mule-Hide Poly ISO 1 and Poly ISO 2 Insulation and other Mule-Hide approved components may be required when such components are to be included as part of the system warranty. Other components not labeled by Mule-Hide will not be considered for inclusion in the Mule-Hide warranty.
- D. Approved insulation adhesives may be used for adhering insulation to approved substrates, insulation to insulation, and approved cover boards to insulation. Refer to the Mule-Hide Living Roof Systems Attachments I, II and III for specific assemblies.
- E. Refer to Product Data Sheets and Material Safety Data Sheets for cautions, warnings and additional product information.

2.04 Mule-Hide GreenGrid Vegetative Roof Components

- A. GreenGrid Modules
 - 1. Modules are black in color, formed from 150 mil (2.5" and 4" deep modules) and 200 mil (8" deep modules) recycled, 100% post-industrial High Molecular Weight Polyethylene (HMWPE) protected with UV stabilizers and inhibitors. Each jobsite delivered module contains a drainage/root retardant layer in the module and is pre-planted or pre-grown with lightweight growing media and plants of color and type designated by the Building Owner/Owner's Representative (Architect or Engineer).
 - 2. GreenGrid[®] modules are available in the following sizes (Length, width, depth):
 - a. Extensive:
 - 1. 2' x 2' x 4"
 - 2. 2' x 2' x 4" triangle
 - 3. 2' x 4' x 4"
 - 4. 40" x 40" x 4"
 - 5. 18" x 24" x 4"

Note: Saturated weight of 4" deep GreenGrid module is approximately 16 -22 lbs. per sf. wet.
Dry Weight of filled, planted 4" deep module is approximately 11- 13 lbs/sf.
 - b. Intensive:
 - 1. 2' x 2' x 8"
 - 2. 2' x 2' x 8" triangle
 - 3. 2' x 4' x 8"

Note: Saturated weight of 8" deep GreenGrid module is approximately 35+ lbs. per sf. wet.
Dry weight of filled, planted 8" deep module is approximately 23+ lbs/sf.
 - c. Weights will vary with regional growing media mix and plant selections.
 - 3. GreenGrid module multi-directional drainage channels clearance above the roof is 0.5 inches.
- B. Protection Fabric - 6oz/yd² and 12oz/yd² polypropylene, non-woven needle-punched fabric that is stabilized to resist soil chemicals, mildew, insects, and is non-biodegradable. Available in rolls 12.5' in width by 100' length.
- C. Growing Media - an engineered lightweight, stable soil blend consisting of both inorganic and organic components. The formulations are based on German FLL (The Landscaping and Landscape

Development Research Society), "Guidelines for the Planning, Execution and Upkeep of Green-Roof Sites". Nutrients & pH adjusted and buffered to meet specifications or the FLL standards.

D. Vegetation

1. Extensive - GreenGrid recommended Extensive plant mixes are composed of highly drought resistant ground covers that can thrive in a non-irrigated (climate dependent), rooftop environment in the project location. Vegetation shall be selected according to their USDA hardiness zone classification.

Recommended planting density - Vegetation should be supplied in a minimum size of 2-inches deep by 1.5-inches wide (plugs) and planted 4 to 6 inches on center (18 to 16 plants per 2x4 module, respectively).

2. Intensive – GreenGrid recommended Intensive plant mixes shall include grasses, perennials, and/or groundcovers that can thrive in an irrigated or non-irrigated, rooftop environment in the project location. Plants shall be selected according to their USDA hardiness zone classification.

Recommended planting density - Vegetation should be supplied in grow-plug or quart size containers and planted in the GreenGrid® green roof modules at a rate of 8 to 12 inches on center (11 to 8 plants per 2x4 module, respectively).

3. Vegetation shall be installed in accordance with the landscape design

- E. Ecoballast® (optional) – Filled with aggregate, Ecoballast® provides modular roof ballast with pre-determined water retention capability. Weight per square foot may be adjusted but a minimum of 10 lbs. per square foot is recommended. May be used for walkways or firebreaks.

2.05 Other Optional Products

A. Root Barrier (optional)

If required, 40-mil non-reinforced Geomembrane is a non-reinforced polypropylene sheet specifically formulated for use in below grade applications to resist root growth and soil bacteria. May be installed directly over the roofing membrane in place of the protection fabric when specified. May be used with either Intensive or Extensive GreenGrid module systems.

- B. Concrete Pavers (optional) - 2' x 2' x 2" thick precast concrete pavers weighing a minimum of 18 psf. with a minimum compressive strength of 6500 psi.

C. Rubber Pavers (optional):

1. Standard Paver size: 2 feet by 2 feet, and 1.75-inches in depth. Various paver depths are available.
2. Pavers are composed of 100% recycled rubber and are available in various colors Standard Paver weight: 7.5 lbs. per square foot.

- D. Stone Ballast (optional) - Nominal 1-1/2" diameter rounded water worn gravel which conforms with ASTM D448, gradation size #4, applied at a minimum of 10 lbs per square foot.

- E. Edge Treatments (optional) – Painted aluminum or painted steel, or other specialty materials (in various colors and designs) can be included as part of the GreenGrid® system design.

- F. Irrigation Systems (optional) - Irrigation requirements will be dependent upon project location and plant selection. For Extensive GreenGrid® Systems planted with a mix of highly drought resistant ground covers, an irrigation system is generally not needed (exceptions do apply to some arid climates). However, GreenGrid® strongly recommends a backup system to irrigate the green roof during prolonged droughts or during hot dry windy weather patterns. Simple overhead spray system with spray heads,

or spigot/hose/sprinkler systems are inexpensive and effective methods. These also provide the means to optimize the evaporative cooling effect of the GreenGrid® Green Roof System during such weather events.

PART 3 Execution

3.01 General

Always attempt to install the roof waterproofing system in a manner to prevent moisture infiltration and minimize construction traffic and material storage on the completed sections of the roof.

3.02 Roof Deck Criteria

It is the responsibility of the building owner to provide proper decking. The building structure should be investigated by a registered engineer to assure its ability to withstand the total weight of the specified roofing system, as well as construction loads and live loads, in accordance with all applicable codes. The specifier must designate the maximum allowable weight and location for material loading and storage on the roof.

- A. Extensive Systems - any roof deck may be used provided the deck is capable of withstanding the roof loading.
- B. Intensive Systems - structural concrete roof decks are recommended due to the increased weight of the roof system when the assembly is at its maximum water capacity.
- C. Defects in the roof deck must be documented and reported to the general contractor, specifier and building owner. Work shall not proceed until the defects have been corrected.
- D. The building owner/owner's representative is responsible for confirmation that the deck will withstand the maximum foreseeable dead and live loads.

3.03 Substrate Requirements

The substrate shall be dry, clean, smooth, free of debris, sharp edges, protrusions, foreign material, ice, snow or any accumulated water. Cracks or voids greater than 1/4" wide should be filled or covered with a suitable material.

3.04 Installation

- A. Insulation Installation
 - 1. Insulation shall be secured to the roof deck as specified in each applicable Mule-Hide Living Roof System Attachment (I, II or III).
 - 2. Refer to the insulation manufacturer's guidelines for appropriate type, size and thickness of the insulation needed for use over the respective substrate and under the Mule-Hide membrane. Insulation shall be of a type and minimum thickness as will be necessary to withstand the loads of the GreenGrid® vegetative roof system. Refer to the specific Mule-Hide Living Roof System Attachment for additional information and requirements.
- B. Membrane Installation

Follow the Mule-Hide applicable EPDM or TPO roofing specification for specific surface preparation, membrane positioning, and application requirements.
- C. Membrane Seaming
 - 1. EPDM seams shall only be completed with the use of Mule-Hide Tape Primer and In-Seam

Tapes. Tape seams shall be a minimum of 2-1/2" wide and overlaid with a minimum 6" wide EPDM Cured Cover Tape. Seaming procedures contained in the appropriate system specification must be followed. Splice Adhesive is not permitted for field seaming.

2. When using reinforced EPDM membrane all field seams must be completed with 6" wide In-Seam Tape and then covered with 6" wide Cured Cover Tape. Splice Adhesive is not permitted for field seaming.
3. TPO Seams shall be completed, wherever possible, using an Automatic Hot Air Welder. A minimum weld width of 1-1/2" is required. Hot air hand welders may only be used for vertical seams, completing various details or those areas where an automatic welder cannot be used. All T-Joint seam intersections must be overlaid with a hot air welded 6" x 6" section of TPO non-reinforced flashing. All seams shall be covered with either 6" wide TPO Cover Strip (with pressure-sensitive adhesive) using Mule-Hide Tape Primer or 6" wide TPO Reinforced Flashing Strips heat-welded in place.
4. When requesting a 20-yr system warranty, all seams on the TPO roofing system shall be stripped in with Mule-Hide 6" wide TPO Reinforced Flashing Strips. The strips must be hot air welded along all edges with a minimum weld width of 1-1/2". Cut-Edge Sealant is required along all cut edges of stripping.
5. Proper seam preparation for all seams contained in our Mule-Hide published specifications must be strictly followed. Refer to the specific Mule-Hide Living Roof System Attachment (I, II, or III) for additional information and requirements.

D. Flashing

1. Walls, curbs, skylights and all other penetrations through the membrane must be flashed in accordance with Mule-Hide's published specifications/details for the applicable membrane specified.
2. When using a fleece backed membrane, at roof drains and wall/curb flashings (at compression seal terminations such as terminations bars and coping stones), the **fleece-backing must be removed** from the back of the membrane so Water Cut-Off Mastic can be applied directly to the TPO membrane surface.
3. When using **90-mil EPDM** membrane, all **flashing details shall conform to Mule-Hide's Adhered 30-year Specification Enhancements and Details.**

E. Roof Drains

With the use of the GreenGrid modules, roof drains should have 1-1/2" nominal diameter rounded river washed gravel applied around the drain sump area (the exposed membrane area between the drain clamping ring and the GreenGrid modules.) for drainage. Strainers must always be installed over the drains and properly secured. **Do not set GreenGrid modules over any drains.**

3.05 Preparation for the Application of the GreenGrid Modules

A. Inspection of the Roofing System

1. The final inspection of the roofing system and all punch list items shall be completed prior to the installation of the GreenGrid modules.
2. A water test is strongly advised to ensure the waterproof integrity of the membrane system. After the membrane and flashings have been in place approximately 24 hours, plug drains and provide necessary barriers to contain water. "Flood" membrane surface with water to a depth of 2" for a period of 24 hours. Inspect for leaks and repair membrane. If defects are found, retest after repairs have been in place for at least 24 hours. Make sure the weight of the water in the flood

test areas will not overload the roof. Owner's representative (Architect/Engineer) must confirm loads placed on roof by flood testing are within safe limits.

3. Depending on the type of membrane used, electronic testing may be used in lieu of flood testing.

B. Site and Surface preparation

1. Traffic over completed roof membrane should be limited to essential personnel only. Heavily traveled areas (staging areas, corridors used to transport GreenGrid roof components) must be protected using 1/2" thick plywood or other sheathing.
2. Make sure all areas where the GreenGrid Modules are to be installed have been swept clean and all dirt, debris and loose or foreign material has been removed.
3. On ballasted roof systems where temporary ballast has been installed, only remove enough temporary ballast necessary to install the GreenGrid modules each day.
4. A staging area should be set up on the roof to receive the GreenGrid modules. The roof membrane in the staging area should be covered with 12-oz/yd protection fabric followed with 1/2" thick plywood or other sheathing to protect the membrane until the installation is completed.
5. Make sure the staging area can withstand the additional weight load of the pallet/cart of stacked modules. This could add as much as 1000 - 1500 lbs of additional weight. The modules should be immediately distributed to their locations on the roof prior to deliver of the next pallet to the roof.

3.06 Application of GreenGrid Modules and Accessory Components

- A. A 6oz/yd² or 12oz/yd² protection fabric (See Mule-Hide Living Roof System Attachments) is unrolled directly over the roof membrane just prior to installing the GreenGrid modules. Provide a minimum of 3" overlap for side and end laps.
- B. It is not required to extend the protection fabric up the side of vertical surfaces except in those areas where loose stone or pavers may be placed. All modules should be kept a minimum of 1" from all vertical surfaces.
- C. Place modules over the slip-sheet in the desired locations in accordance to the landscape design.
- D. Modules shall be installed in straight rows, tight against each other, and arranged in the proper directional orientation.
- E. Installed modules shall be watered sufficiently with a fine spray so as to thoroughly moisten the growth media from top to bottom. Water shall be free of substances harmful to plant growth. The Contractor shall furnish hoses or other methods of temporary irrigation.

3.07 30-Day Maintenance Schedule Requirements

- A. Installation contractor shall maintain the GreenGrid® modules for a period of at least 30 days after completion prior to acceptance from building owner.
- B. 30-Day maintenance shall include:
 1. Water the GreenGrid® System once a week (weather dependent) to aid in plant establishment. System shall be watered more frequently during extended hot and dry weather especially when plants are showing signs of wilting.
 2. Perform spot weeding as necessary.

3. Repair, rework, and replant all areas that have washed out or are eroded. Replace undesirable or dead areas with new plants.
4. Apply suitable bio-controls, fungicides, or insecticides only as required to control diseases and insects. Comply with all applicable local, State and Federal regulations and label instructions when applying these materials.

3.08 ACCEPTANCE

- A. Inspection to determine acceptance of modules will be made by the Owner, upon Contractor's request. Provide notification at least 7 working days before requested inspection date.
- B. Modules will be acceptable, provided all requirements, including maintenance period, have been complied with, and healthy, even colored viable plants are established.
- C. Upon acceptance, the Owner will assume full responsibility for module/plant maintenance.

3.09 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment.

END OF SECTION

Always check the Mule-Hide Website (www.mulehide.com) for the latest revisions to this document. Mule-Hide reserves the right to make changes without notice.

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