



# Technical Guide

## GUIDELINES FOR ROOF MOUNTED PHOTOVOLTAIC INSTALLATIONS

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### 1. General

Information included in this document is to be used as a guideline when a Photovoltaic (PV) system is to be installed over a new or existing Mule-Hide roofing system.

Installation of a PV system will subject the roofing assembly to extensive alteration work with an increase in foot traffic both during installation and after installation (monitoring and maintaining of the PV system). When assessing a roof assembly for a potential PV system, consideration must be given to not only the operation of the PV system, but to the functionality of the roofing system and overall drainage. This includes protection of the roofing system from the associated PV activities, maintaining accessibility of the roofing system for adequate inspections, maintenance and repair.

Whenever additional loads are placed on a building or modifications are made to existing systems, prudent best practices mandate a comprehensive review by a licensed design professional. Prior to committing to or proceeding beyond a preliminary design of a PV system, a structural analysis by a registered Professional Engineer should be performed to ensure structural load limitations will not be exceeded.

Items to be considered include climate and geological conditions, structural load limitations, roof height, mounting system, number of membrane penetrations and roof slope.

### 2. Design Considerations

In addition to Mule-Hide's published roofing system specifications, the following design recommendations are to be considered when a PV system is intended to be installed over a new or existing Mule-Hide roofing system.

Mule-Hide does not promote, approve or warrant any PV system design. The design of a proposed PV system may be submitted to Mule-Hide for assessment and recommendations related to the roofing system. The building owner is responsible to ensure that the roofing system is adequately protected during all phases of the PV system installation and service life.

- a. On new roof installations that are slated for a PV installation, Mule-Hide recommends the use of a fully adhered membrane roof system utilizing an adhered rigid cover board (e.g. Dens Deck Prime or Securock) to increase the puncture and traffic resistance of the roofing system. Mule-Hide recommends the use of a roof assembly tested to meet UL Class A.
- b. On projects with an existing Mule-Hide roofing system, the membrane condition and installation details should be assessed to determine if existing field seams should be overlaid or if specific areas of the roofing membrane should be removed and replaced. A roof assessment should be coordinated through Mule-Hide and performed by a Mule-Hide Technical Representative prior to finalizing any repair or upgrades to the roofing system.
- c. Rack-supported PV arrays should provide proper clearance to allow for easy access to the roof

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membrane for maintenance or repairs if necessary. Such access will help to eliminate costly removal and re-installation of PV modules that conceal or cover the roofing system.

- d. When a PV mounting system requires that the roofing system be penetrated, the use of circular steel tubing will provide the best possible flashing option and facilitate the use of pre-molded accessories. In such instances, Mule-Hide specifications and details should be followed and the flashing performed by a Mule-Hide Warranty Eligible Contractor to ensure that the roofing warranty will not be voided.
- e. The following anchors may be used on Mule-Hide warranted projects if they are ordered with Mule-Hide membrane flashing material. The water tightness of the flashing/seams for these anchors are eligible for coverage in the Mule-Hide Warranty if installed by a Mule-Hide Warranty Eligible Contractor.
  - 1. Anchor Products U-Anchor 1400 – TPO, PVC (Standard & KEE), EPDM, Mod Bit (APP & SBS)
  - 2. Anchor Products U-Anchor 2400 – TPO, PVC (Standard & KEE), EPDM, Mod Bit (APP & SBS)
  - 3. Anchor Products U-Anchor 3400 – TPO, PVC (Standard & KEE), EPDM, Mod Bit (APP & SBS)
  - 4. Anchor Products U-Anchor 3400S –TPO, PVC (Standard & KEE), EPDM, Mod Bit (APP & SBS)
  - 5. Anchor Products U-Anchor 4400 – TPO, PVC (Standard & KEE), EPDM, Mod Bit (APP & SBS)
- f. Areas of the roofing membrane that are heavily traveled during array installation and subsequent periodic maintenance, should be protected with walkway pads and/or concrete pavers. If pavers are selected, they should be used in conjunction with pedestals or sections of walkway pads, used to elevate the pavers.
- g. Ballasted PV systems should utilize a protection course between the ballast trays of the racking system and the roofing membrane to provide protection and facilitate drainage. A protection course shall be of sufficient construction so as to prevent contact between any component of the PV racking system and the roofing membrane for the life of the roofing system. Examples of protection courses are Mule-Hide TPO Walkway Roll, Mule-Hide Walkway Pad or a Mule-Hide approved component supplied by the racking system manufacturer. Any component supplied by the racking system manufacturer and its interaction with Mule-Hide roofing system will not be covered under the Mule-Hide warranty.
- h. Non-penetrating attachment methods that rely solely on a heat welded seam for anchoring to a thermoplastic membrane shall not be allowed. Any anchoring system, whether used as a primary or ancillary securement method, should tie directly to the roof deck or a structural component of the building. The anchoring system should possess adequate holding power to resist any loads to which the PV system may be exposed. Mule-Hide does not sell solar panel anchor systems and will not warrant any part or function of an anchoring system beyond flashing details installed by a Mule-Hide Warranty Eligible Contractor.
- i. PV laminates should not be directly adhered to a Mule-Hide roofing membrane. Regardless of age or condition, roofing membranes should be overlaid with similar material prior to adhering the PV laminates. This practice of using sacrificial sheets will facilitate the removal and re-installation of the laminates should access to the roofing membrane be required.

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- j. In order to minimize interruptions to a PV system's production, it is strongly recommended to position the array(s) so that field seams and penetrations are accessible for roofing inspections, maintenance and repair. When not feasible, all existing seams should be overlaid (stripped in) with pressure-sensitive flashing or other acceptable flashing details approved by Mule-Hide.

### 3. Roof Assessment

Prior to beginning of any work, new and existing roof installations with a valid Mule-Hide system warranty will require a roof assessment to be performed by a Mule-Hide Technical Representative to assess roof condition and to review the proposed installation.

### 4. Warranty Inspections

- a. All work shall be completed by a Mule-Hide Warranty Eligible Contractor and must be performed in accordance with Mule-Hide specifications or previously issued roof assessment reports written by a Mule-Hide Technical Representative
- b. Upon completion of the work, and notification by a Mule-Hide Warranty Eligible Contractor, an inspection will be performed by Mule-Hide to assess the work performed. All Mule-Hide field inspections are conducted for a fee. Should multiple inspections be required, a fee will be charged for each occurrence. Refer to the Solar Pre-Installation form for inspection fees.
- c. Upon inspection and acceptance, and payment of all fees, a Warranty Addendum letter will be issued by Mule-Hide to the Building Owner. The Warranty Addendum will define additional warranty terms and should be retained with the original warranty for future reference.

### 5. Warranties

The installation of a roof mounted PV system will subject the roofing membrane to excessive traffic during the installation, operation and maintenance of the PV system. Access for membrane repairs may require that portions of the PV system be dismantled. Therefore, it is important that the durability of the roofing system be enhanced to minimize the potential for damage or probability of leaks.

For new or existing projects, the Mule-Hide system warranty will only cover deficiencies in Mule-Hide supplied materials and labor provided by a Mule-Hide Warranty Eligible Contractor to install those materials.

- a. Damages to the Mule-Hide roofing system resulting from PV operation, maintenance or installation are beyond the coverage of the Mule-Hide warranty.
- b. Should dismantling and/or removal of the PV system or components be required in order to complete repairs or inspections covered by the Mule-Hide warranty, any costs associated with the removal and replacement of the PV system, as well as any increase in repair cost due to limited access caused by the PV system shall be the Owner's responsibility and are not covered under the Mule-Hide warranty. Owner shall be responsible for all costs associated with any loss of power generation in the event that removal of a solar panel/array is required to repair the roofing system.

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### 6. Quality Assurance

It is the building owner's responsibility to comply with all applicable codes. When selecting a PV system, the PV module manufacturer should be consulted to verify that the use of their product will not adversely affect the fire code classification of the roof assembly.

### 7. Cautions & Warnings

- a. Areas designated for staging of roofing, restoration materials and PV array components, should be protected to prevent damage to either the roofing membrane or underlying insulation.
- b. Maximum distributed, lateral and point loads should be determined by the building owner or his/her design professional to avoid exceeding the maximum compressive strength of the roofing assembly or the maximum loads for which the structure has been designed.
- c. Coordination between various trades (Mule-Hide Warranty Eligible Contractor and PV system installer/electrician) is essential to minimize delays, avoid unnecessary rooftop traffic over/through completed sections, prevent excessive soiling of highly reflective membranes and avert possible physical damage to the roofing membrane and/or insulation.
- d. On new or existing membrane installations, attachment of slip-sheets, walkway pads, sacrificial sheets and all necessary flashings/terminations or modification to the roofing assembly must be performed by a Mule-Hide Warranty Eligible Contractor. **Failure to comply will result in negating the issuance of a Warranty Addendum and possible termination of all existing warranties.**
- e. Non-penetrating attachment methods that rely solely on a heat welded seam for anchoring to a thermoplastic membrane shall not be allowed. Any anchoring system, whether used as a primary or ancillary securement method, should tie directly to a structural component of the building. **Failure to comply will result in negating the issuance of a Warranty Addendum and possible termination of all existing warranties.**
- f. Walkway pads, protection pads, slip sheets and sacrificial sheets shall be of the same color as the roofing membrane when possible.
- g. Mule-Hide will not warrant or approve the integrity, installation or performance of any PV system or PV system component.