

Preparing for Photovoltaic Installations

Roof-Mounted Applications
Existing/New Roofing Projects



August 2009

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A. General

Information included in this document is to be used as a guideline for consideration when a Photovoltaic (PV) system is to be installed on top of an existing or new Versico roofing system.

PV installations will subject the membrane assembly to extensive alteration work (depending upon the type of PV system selected) and frequent traffic for the purpose of monitoring and maintaining the solar arrays. When assessing a roof assembly for a possible PV installation, consideration must be given to not only the PV system operations, but also to the level of traffic expected and accessibility to perform repairs adequately.

Photovoltaic systems vary in type from integrated panels to roof-bearing and curb-mounted. Climatic conditions, structural load limitations, the PV mounting method, frequency of membrane penetration, and the roof slopes must all be taken into account.

B. Design Considerations

In addition to the design considerations outlined in each of the Versico published roofing system specifications, listed below are additional design guidelines which must be considered when a PV system is to be installed on an existing or a new Versico roofing installation.

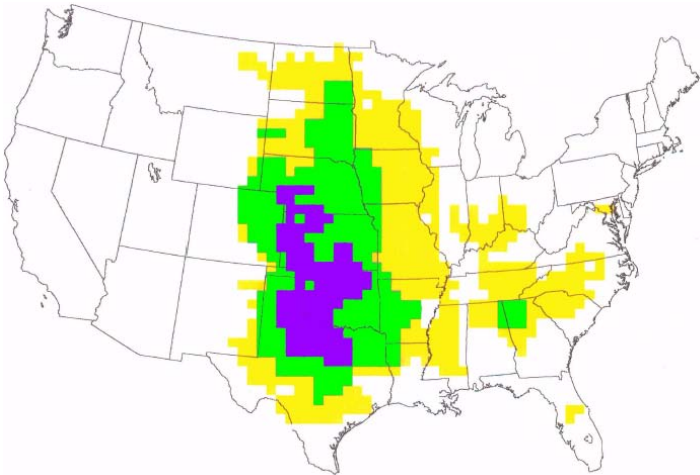
1. Prior to the selection of a PV system, a structural analysis must be performed to ensure structural load limitations will not be exceeded.
2. On projects with an existing Versico roofing membrane, membrane condition and installation details should be assessed to determine possible splice overlayment or the removal and replacement of certain membrane sections. A Roof Assessment shall be coordinated through Versico and performed by a Versico field service representative prior to finalizing any upgrades/repairs.

3. Due to excessive heat generated by flexible thin-film PV laminates (Versico or others), the use of extruded or expanded polystyrene insulation directly beneath a white membrane will not be permitted. The use of rigid insulation boards, i.e. DensDeck, Securock or HP Recovery Board, must be specified.
 - a. On existing projects where extruded or expanded polystyrene insulation is directly beneath the membrane, a different type of PV system in lieu of the flexible thin-film laminate may be considered or the removal of the membrane may be specified along with the addition of a rigid insulation board as stated above.
4. Rack-supported PV systems must provide proper clearance to access the roof membrane for the purpose of maintenance or repairs when necessary, eliminating costly removal of the PV panels.
5. When penetration of the membrane is required to secure panel supports to the roof structure beneath the membrane, the use of rounded steel tubing/pipes will provide the best possible flashing option and facilitate the use of pre-molded accessories. In such instances, Versico specifications and details must be followed to ensure that the warranty will not be voided.
6. Areas of the roof membrane which are **heavily traveled** during periodic array maintenance must be protected with walkway pads and/or concrete pavers. If pavers are selected, they must be used in conjunction with pedestals or sections of walkway pads, used to elevate the pavers.
7. Ballasted PV systems, depending on their type and configuration, may require the use of protection pads/slip sheets of membrane to provide protection and facilitate drainage. **The proposed design should be presented to Versico for assessment and specific recommendations.**
8. **PV laminates by others**, when specified, cannot be directly installed over the warranted Versico roofing membrane. Regardless of age or condition, existing or new roofing membranes must be overlaid with similar material prior to attachment of the PV laminate. In addition, installation requirements for the Versico SpectroFlex™ thin-film PV laminate should be followed as referenced below.
9. **SpectroFlex – A Versico-supplied photovoltaic system**
 - a. A flexible thin-film laminate PV that utilizes amorphous silicon technology in a multi-layered design and allows for low-light operation and reduced temperature sensitivity.
 - b. This thin-film, peel & stick laminate weighs less than 1 lb/ft² and is available in lengths of approximately 9'x15.5" and 18'x15.5". The

laminate can be adhered directly to the primary roofing membrane or to a sacrificial slip-sheet which is then attached to the primary roofing membrane, eliminating membrane penetration or the need for a racking system.



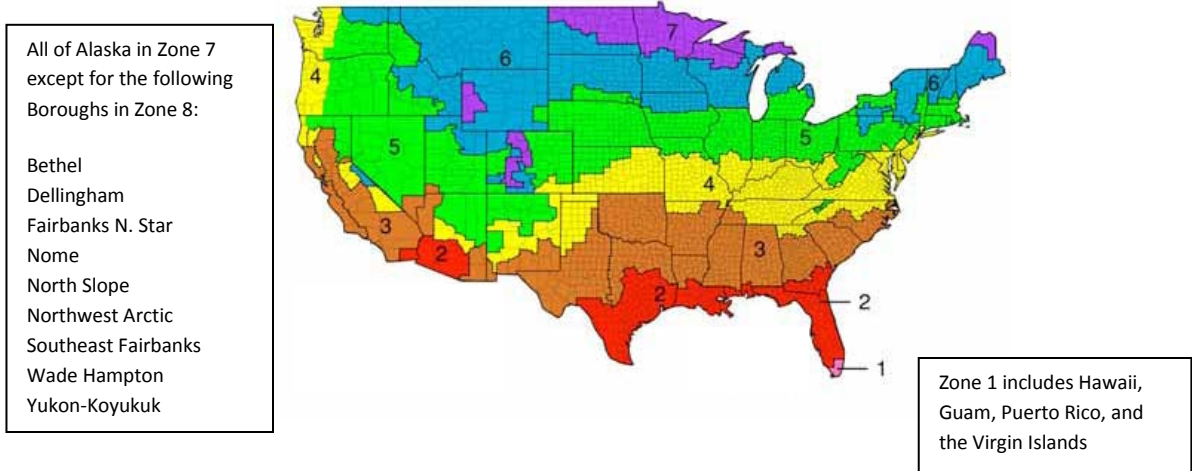
- c. The SpectroFlex peel & stick laminate can be used with EPDM or TPO membranes of any color. Their efficiency will not be reduced on roofs of low-slope (1/4" or less), as long as ponded water is eliminated through the use of tapered insulation.
- d. To maintain the power performance efficiency of the SpectroFlex, periodic maintenance to remove accumulated snow will be necessary, along with washing in locations where excessive soiling of the laminate will be encountered.
- e. For projects in locations where excessive maintenance is required (periodic snow removal or periodic washing) and where the PV arrays are subject to severe hail (green and purple zones as outlined in the map), it is recommended to incorporate a rigid board of DensDeck or Securock beneath the membrane to reduce the probability of indentations and subsequent stains through soiling.



0.5" - 1.0" Hail 1.0" - 2.0" Hail 2.0" - 4.0" Hail

- f. In ASHRAE Zones 4 through 8 (see map below), the SpectroFlex laminate may be installed directly to EPDM or TPO membranes of thicknesses not less than 60 mil.

- g. Projects located in ASHRAE Zones 1 through 3, especially those in the Southwest and on the West Coast (New Mexico, Arizona, California, and Texas) should incorporate a minimum of 72 mil TPO membrane or minimum 60 mil EPDM when SpectroFlex is to be directly adhered to the primary roofing membrane.



ASHRAE Climatic Zone Map

Existing roofs with membranes less than 60 mil in thickness or thicknesses of less than 72 mil (for projects located in Nevada, New Mexico, Arizona, California, and Texas) will require the use of a slip-sheet of new membrane beneath the SpectroFlex laminate unless otherwise approved as a result of the Versico roof assessment.

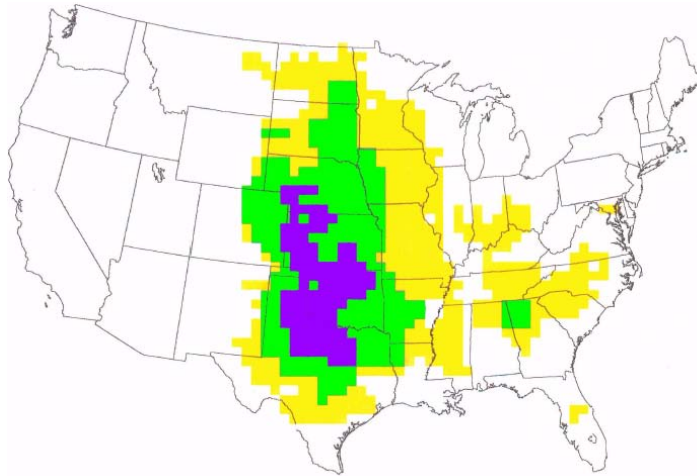
Note: Existing membrane installations with thicknesses less than 60 mil must be evaluated during the field assessment to determine the feasibility of direct application.

10. Spectro360™ – A Versico-supplied photovoltaic system

- a. Self-tracking panels with cylindrical tubes. Available in lengths of approximately 6' x 3.5' and heights of 12". Each panel weighs approximately 70 lbs (21 kg.) or 3.3 lbs/ft². Panels connect, to form a self-ballasting design eliminating roof penetration.



- b. The Spectro360 is designed for use over reflective VersiWeld TPO, VersiGard White EPDM or VersiFlex PVC membranes. The Spectro360 may also be used in conjunction with non-Versico reflective roof membranes.
- c. Installation of the Spectro360 PV panels shall be limited to maximum slopes of 2" vertical rise per 12" horizontal, to reduce the possibility of shifting.
- d. The Spectro360 is not intended nor is it recommended for use in hail-prone areas. See map below for hail zones.



0.5" – 1.0" Hail 1.0" – 2.0" Hail 2.0" – 4.0" Hail

- e. In snow-prone areas, and in the presence of slopes of ½" or greater, or in the locations where winds in excess of 90mph are expected, special provisions to prevent shifting of panels may be necessary. Please contact Versico for further information.
- f. When installing Spectro360 on new membranes, the minimum thickness shall not be less than 60 mils to accommodate for periodic traffic associated with maintenance and monitoring of PV arrays.

- g. Existing roofs with membranes of thicknesses less than 60 mil may be considered when proper measures are taken to protect membrane against excessive traffic. Such consideration will also take into account the membrane's age and geographic location.
 - h. Excessive soiling of existing membranes will reduce PV power performance. In lieu of membrane cleaning, a slip sheet of a reflective new Versico membrane may be specified to improve panel performance and to offer added protection to the primary roofing membrane.
11. When PV array configuration makes certain areas of the roof difficult to access without disturbing the PV operation, it is strongly recommended to position the arrays so that field seams and other penetrations are accessible. When not feasible, all existing seams must be overlaid with pressure-sensitive flashing or other acceptable flashing details approved by Versico or the roofing membrane manufacturer.

C. Submittals

All projects, new or existing, will require a shop drawing outlining the type of PV system selected, array locations and areas where the membrane is to be penetrated, along with flashing details. The drawing should also include seams which are being overlaid or areas where slip-sheets or protection for the existing membrane is to be employed. The drawing must be submitted for Versico's approval, preferably prior to commencement of any work and prior to field inspection.

1. For existing Versico installations where a PV system is proposed, a copy of the Versico Roof Assessment Report should be sent along with the shop drawings or the report number should be referenced.
2. Deviations from the previously approved drawings or modifications to the Versico Roof Assessment should be forwarded for Versico's review and approval prior to proceeding with the work.
3. New Versico installations, in addition to the above, will require submittal of the standard "Request for Warranty" forms and Job Completion form.

D. Versico Roof Assessment

Prior to commencement of any work, existing roofing installations with a valid Versico membrane system warranty will require a roof assessment to be performed by a Versico field service representative to assess roof condition and to review the proposed installation.

A roof assessment report outlining recommended installation details will be issued and used as a guideline for the PV installation work to be performed.

The roof assessment service is available from Versico for a charge when a **non-Versico PV system** is being considered.

E. Warranty Inspections

1. Upon completion of the work, and notification by the authorized roofing contractor, an inspection will be performed by Versico to assess the work performed. Upon acceptance by Versico, a membrane system warranty will be issued for new roofing installations or a reinstatement of warranty for existing projects.
2. All field inspections are conducted by Versico for a fee. Should multiple inspections be required, a fee will be charged for each occurrence. The authorized roofing contractor should ensure all work is completed in accordance with the Versico specification, approved drawings or previously issued roof assessment reports.
3. On an existing project where a PV system is being installed, the Versico warranty will be temporarily suspended until all the work is completed and the project is accepted by Versico. A warranty reinstatement document will be issued outlining new conditions of the warranty. The warranty reinstatement will take effect upon Versico's final acceptance and receipt of all payments/fees.

F. Warranties

Installation of a PV system will subject the roofing membrane to excessive traffic during installation, operation, and maintenance of the PV array. Access for membrane repairs may require dismantling of modules in certain locations; therefore, it is important to enhance the membrane system durability to minimize the potential for damage or the probability of leaks.

1. For existing Versico projects, a warranty reinstatement document will be issued upon inspection and acceptance of roofing alterations, in accordance with Versico-approved drawings and guidelines contained in the Versico Roof Assessment Report.

The warranty reinstatement will take effect once all payments and inspection fees have been paid.

2. For new or existing projects, the Versico roof system warranty will cover deficiencies in Versico-supplied material or labor performed by the Versico authorized roofing contractor.
 - a. Damages to the roofing system resulting from PV operation or maintenance are beyond the coverage of a new or reinstated Versico warranty.
 - b. Should the removal of a PV array or the dismantling of a PV module be required to complete repairs covered by the membrane system warranty, costs associated with removal and replacement and any increase in repair costs due to limited access shall be the owner's responsibility and are excluded from the warranty.

3. Performance of the PV is not included in the roof system warranties mentioned herein. A separate warranty covering all Versico-supplied PV components is available from Versico Energy Services, for projects where a Versico PV system has been purchased.

G. Quality Assurance

The building owner or his designated design professional must investigate and comply with all local applicable codes.

1. When selecting a PV system by others, the manufacturer must be consulted to verify if the use of their product will not adversely impact the fire code classification for the roof assembly.
2. SpectroFlex meets UL Classifications (Class A, B, or C) when installed over any UL classified Versico roofing membrane assembly.
 - a. SpectroFlex may be applied directly to the roofing membrane (refer to Design Considerations for specific requirements) or indirectly to an intermediate roofing material layer of the same type.
 - b. The intermediate layer of membrane is loose-laid over the primary roofing material, and then heat-welded to a Sure-Weld membrane, or attached with SecurTAPE to an EPDM roofing membrane.
 - c. The UL classification for the roofing membrane assembly will be limited to slopes of $\frac{3}{4}$ " with the use of SpectroFlex, even though the assembly may have met classification for a higher incline.
 - d. UL classification can be extended to slopes of $1\frac{1}{2}$ " with the use of gypsum board under a UL classified Versico roofing membrane.

The UL classification stated herein applies to combustible or non-combustible decks.

H. Cautions & Warnings

1. Areas designated for stacking of roofing or restoration materials and PV arrays shall be protected to prevent damage to the membrane or the insulation below. Maximum allowable weight should also be determined by the building owner or his design professional to avoid exceeding the maximum load for which the structure has been designed.
2. Coordination between various trades (Versico authorized roofing contractor and PV system installer/electrician) is essential to avoid unnecessary rooftop traffic over completed roof sections and to prevent excessive soiling of white membranes or possible physical damage.
3. On existing or new membrane installations, attachment of PV laminates (Versico or others), slip-sheets, walkways, protection surface material, and all necessary flashings/terminations must be

performed by a Versico authorized roofing contractor in accordance with previously approved Versico drawings. **Failure to comply will result in negating the issuance of a membrane system warranty or termination of all existing warranties.**

4. All materials contributing to the integrity of the roofing system, including, but not limited to membranes, flashing, adhesives/tapes, walkway pads, and terminations must be manufactured or supplied by Versico or determined by Versico as compatible.
5. Work shall be coordinated between the authorized roofing contractor and PV installer to ensure all electrical connections are installed in accordance with applicable local codes and by a licensed electrician. Warning signs must be posted and areas evacuated until any deficiencies are remedied.

I. Jobsite Considerations

Material Safety Data Sheets (MSDS) must be on location at all times during transportation, storage, and application of materials. The authorized roofing contractor and PV system installer shall follow all safety regulations as recommended by OSHA and other agencies of jurisdiction.

1. Subject to project conditions, it is recommended to begin application of new material or solar arrays roof-mounted support at the highest point, working toward the lowest point of the roof, including the daily completion of all flashing terminations and temporary seals.
2. When installing building integrated PV systems (flexible thin film laminate), areas of the roof where evidence of ponding exists shall be identified and corrected to ensure greater efficiency.
3. When installing curb-mounted PV panels, all curbs shall be constructed to provide sufficient flashing height and must be oriented to ensure full sun exposure and to not obstruct drainage. If necessary, install new tapered insulation and possibly additional drains.
4. Protect membrane surface to reduce the probability of damage and reduce soiling of white membranes. Comply with Versico published specification for washing and cleaning existing membranes to prepare their surface for repair/flashing work.
5. When a new slip-sheet of membrane is to be used for the attachment of flexible thin-film PV laminate, the new membrane need not be fully adhered to existing material (loose-laid or spot-attached will be accepted). All debris must be removed prior to new membrane installation and a watertight splice must be provided between new and existing membranes in accordance with currently published specifications.

J. Membrane Surface Preparation/PV Laminate Attachment

Procedures outlined below are to be used to prepare EPDM or TPO membrane surfaces (primary or slip-sheet) for installation of SpectroFlex thin-film PV laminates.

1. For new or existing membranes, remove heavy dirt or debris with a broom or air blower.
2. For heavily-soiled membranes and membranes which have been exposed to the elements for greater than 7 days, scrub the membrane with a scrub brush using warm water and a low sudsing soap such as Spic-N-Span, Tide or Lestoil (approximately ¼ to ½ cup of cleaner to one gallon of water) or pressure-wash at approximately 2,000 psi.

Note: An electric driven scrubber with a bristle type brush approximately ¾" to 1-½" in length is recommended.

3. Rinse area thoroughly with clean water and allow to dry.
4. Clean area where PV laminate is to be applied with Versico Weathered Membrane Cleaner applied at the rate of 400 ft² (37.2 square meters) per gallon using a saturated clean Splice Wipe, scrubbing in a circular motion. Continue to clean the area, changing wipes frequently.
 - a. A thoroughly cleaned EPDM membrane will be a consistent matte-black color with no streaking.
 - b. A thoroughly cleaned TPO membrane will be a consistent color with no streaking.

Allow cleaned area to dry thoroughly.

5. Unroll SpectroFlex laminates and allow to relax so laminate is laying flat.
6. Peel back 10"-12" (25-30 cm.) of the protective release liner and position laminate over area to be covered, pressing down with a firm hand across the entire area. Continue this process until the entire laminate is attached.
7. Immediately roll entire laminate area perpendicular to the length using a stand-up or hand-held roller, applying constant pressure to achieve full contact with the membrane.