UNI-SOLAR®

Building Integrated Solar Electric Shingles

SHR-17 Solar Electric Shingles

Owner's Manual & Installation Guide

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UNI-SOLAR®

Triple Junction Solar Products.

United Solar Ovonic, LLC ("*UNI-SOLAR*"), the leader in thin-film amorphous-silicon photovoltaics (PV) offers a revolutionary new line of solar electric roofing panels. Unlike other photovoltaic technologies that use glass (heavy, delicate, expensive) to protect their modules, *UNI-SOLAR*® solar modules are flexible, lightweight and architecturally attractive. These rooftop solar systems emulate conventional roofing materials in design, construction, function and installation.

Benefits

- The solar cell is encapsulated in an ETFE fluoropolymer and other weather-resistant polymers. The *UNI-SOLAR* PV roof shingles are UL approved as a roofing product and are non-combustible!

- The Triple-Junction technology provides unprecedented levels of efficiency for amorphous silicon solar cells. Additionally, *UNI-SOLAR* roofing shingles carry a 20-year warranty on the electrical output and physical integrity of the modules.

- All *UNI-SOLAR* roofing shingles have bypass diodes across every cell. This means that if 10% of the module is shaded, you will only lose 10% of the output.

- *UNI-SOLAR* amorphous-silicon photovoltaic products perform better than crystalline products in high heat environments making them the best choice for roof top installations.

- Excellent shadow tolerance (because of the bypass diodes) and excellent performance in warmer climates (due to thermal annealing and low temperature coefficients for power loss) are combined so that *UNI-SOLAR* roofing arrays will provide at least 10% more energy per day compared to crystalline arrays of the same wattage!

- *UNI-SOLAR* building integrated products are less expensive than traditional rack-mounted arrays. System owners can avoid the cost of; 1) the labor to build and install a module support rack, 2) the rack itself, and 3) the extra roofing materials under the rack.

- Building integrated design allows for a lower profile array, reducing vandalism and theft. Breakage due to heavy snow loads is also eliminated.

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Building Integrated Solar Electric Shingle SHR-17
OWNERS MANUAL & INSTALLATION GUIDE

INTRODUCTION

UNI-SOLAR® Solar Electric Shingles (SHR-17) are designed to provide many years of reliable roofing protection and independent electric power. They will perform at their maximum with the proper power system design, installation, use and maintenance. This manual is designed to assist product owners, roofing installers, and electricians in the proper use and installation of this product.

The *UNI-SOLAR* SHR-17 is a rugged, flexible Triple Junction solar module configured into the shape of a composite (asphalt-based) shingle. These solar shingles are laid on the roof just like conventional composite shingles are. Shingles are put on the roof by roofers specializing in composite shingles. Installation of the shingles requires only a few modifications of the conventional composite shingle roofing installation procedures (shingle wire penetration of the roof deck, location of the solar shingles in relation to the composite shingles). Roofing installers should be thoroughly familiar with the standard procedures prior to installation. Questions regarding standard composite shingle installations are not covered by this manual and should be referred to licensed contractors. Only qualified, licensed electricians should undertake wiring of the solar array to the building's electrical system.

UNI-SOLAR SHR-17 solar shingles are designed for use with other specialized equipment, including DC combiner boxes, charge controllers, DC/AC inverters, and interruption equipment. System design and component selection must comply with the National Electric Code (NEC) and all state and local codes. While information regarding the use of *UNI-SOLAR* roofing products, system components and system design can be found in the section titled "Information Concerning PV System Installation", consultation with a solar systems specialist is highly recommended.

DISCLAIMER OF LIABILITY

The information contained in this manual is based on United Solar Ovonic LLC's knowledge and experience, but such information and suggestions do not constitute a warranty expressed or implied. The methods of installation, use and maintenance of PV roofing panels are beyond the control of United Solar Ovonic LLC. United Solar Ovonic LLC assumes no responsibility and expressly disclaims liability for any loss, damage or expense associated with the use, installation or operation of the product. Any liability of United Solar Ovonic LLC is strictly limited to the Limited Warranty to be found in this manual. United Solar Ovonic LLC reserves the right to make changes to product specifications or to this manual without notice.

SAFETY WARNINGS

- The *UNI-SOLAR* Solar Electric Roofing Shingles produce DC electricity when exposed to the sun or other light sources. The power from one individual panel is not considered hazardous. However, if connected in series and/or connected in parallel, the potential shock hazard increases.

CAUTION!!

The *UNI-SOLAR* roofing shingle contains live electrical components enclosed and protected within. Do not cut or trim the photovoltaic shingles in any way. Do not drive screws into any part of the solar shingle except at designated areas at the Head Lap. Doing so can cause electric shock, may result in fire and will void the warranty.

Licensed Roofing Contractors:

- Only licensed roofers should install *UNI-SOLAR* roofing products.
- *UNI-SOLAR* roofing shingles are slippery, especially when wet. Use extreme caution and proper safety harness when working on or near the solar shingles.
- Contact appropriate local authorities prior to installation to determine if permits and inspections are required for your particular area.
- Avoid dropping any sharp objects on the solar shingles.

Licensed Electricians:

- Observe safe electrical practices at all times. Use insulated tools when wiring solar roofing shingles.
- Cover solar roofing shingles with an opaque material before making wiring connections to reduce the risk of electric shock or sparks.
- Observe proper polarity when connecting the solar roofing shingles into an electrical circuit (see section on wiring). Reverse connection will damage the roofing shingles, may result in fire and will void the warranty.
- Avoid dropping any sharp objects on solar electric shingles.

Physical Specifications:

	Shingle Length	Laminate Width	Laminate Thickness	Weight	Customer-Supplied Substrate	Minimum Slope
SHR-17	86.4 in.	12 in. (5" exposed area)	0.12 in.	9 lb.	Wood deck and 30# Felt Paper	3:12

Electrical Specifications:

Specifications and Performance	SHR-17
Rated Power (Watts)	17
Operating Voltage (Volts)	9.0
Operating Current (Amps)	1.9
Open-Circuit Voltage (Volts)	13.0
Open-Circuit Voltage (Volts) at -10°C and 1250 W/m^2	14.8
Short-Circuit Current (Amps)	2.35
Short-Circuit Current (Amps) At 75°C and 1250 W/m^2	3.1
Series Fuse Rating (Amps)	4
Min. Blocking Diode (Amps)	4

NOTES:

During the first 8-10 weeks of operation, electrical output exceeds specified ratings. Power output may be higher by 15%, operating voltage may be higher by 11% and operating current may be higher by 4%.

Electrical specifications (±10%) are based on measurements performed at standard test conditions of 1000 W/m^2 irradiance, Air Mass 1.5, and Cell Temperature of 25°C after long-term stabilization. Actual performance may vary up to 10% from rated power due to low temperature operation, spectral and other related effects.

Maximum system open-circuit voltage not to exceed 600 VDC.

Specifications subject to change without notice.

SOLAR SHINGLE INSTALLATION INSTRUCTIONS

UNI-SOLAR SHR-17 Solar Electric Roofing Shingle

Tools Needed

- Cordless Drill, and 7/8" & 1/2" Drill Bits,
- Chalk Line,
- UNI-SOLAR PV Shingle Template (printed on SHR-17 Box),
- Hammer,
- Roofing Nails,
- Drilling Template,
- Safety Harness.
- 5" long piece of 2X4 or scrap wood. (Used as a drilling aid in 2.6)

1.0 Deck Preparation

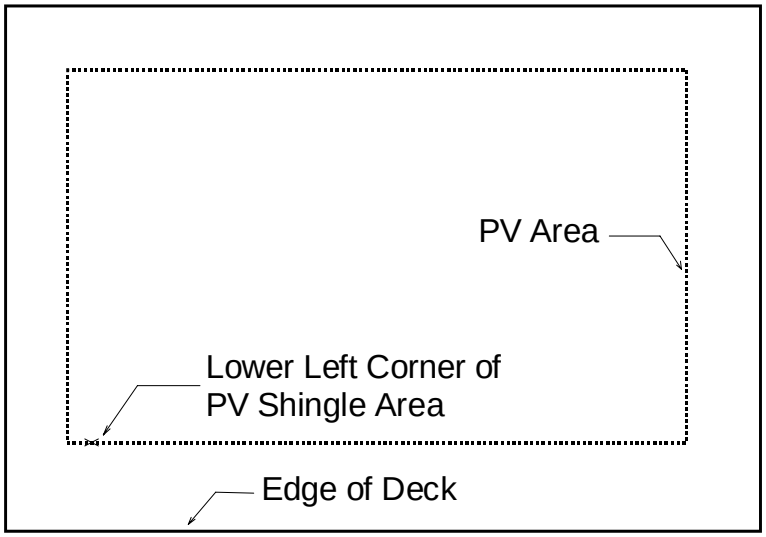


Figure 1

NOTE: Reference figures 1 through 3 for steps 1.1 through 1.6. Deck must be flat, with no sagging or buckling of plywood and free of protrusions such as high fasteners, plywood splinters etc.

1.1 Layout Elk VersaShield (or equivalent fire-resistant underlayment) on the deck where the solar shingles will be located. Lay out 30 lb., ungranulated, felt paper (or equivalent) over the rest of the deck.

1.2 Prior to installing the PV shingles determine the starting position of the first PV shingle. Place a mark on the deck at the lower left corner of where the first PV shingle will be. This position should be in increments of 5" from the bottom edge of the first row of asphalt shingles (see figure 1).

1.3 Using the mark in step 1.2. Snap a horizontal chalk line (parallel to ridge) along the length of the PV section of the deck (see figure 2).

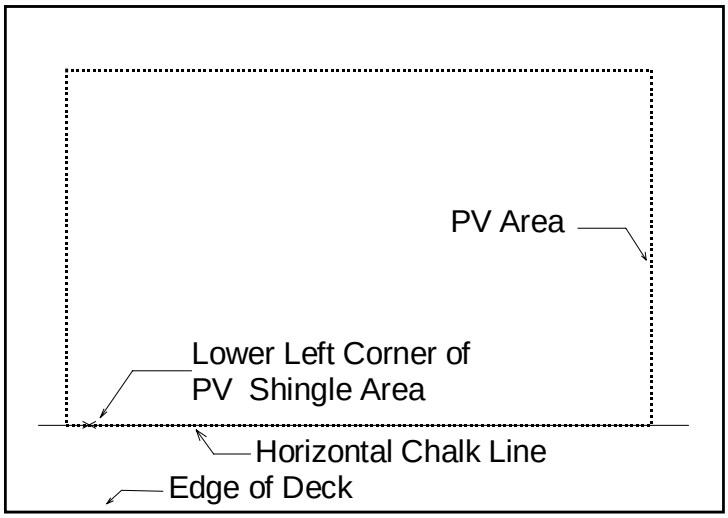


Figure 2

1.4 To establish the template starting point, measure 20" (50.8cm) from left corner point along horizontal line and mark position (see figure 3).

1.5 For every PV shingle on first row, measure an additional 86.4 inches (219.5cm) along horizontal line and mark position (see figure 3).

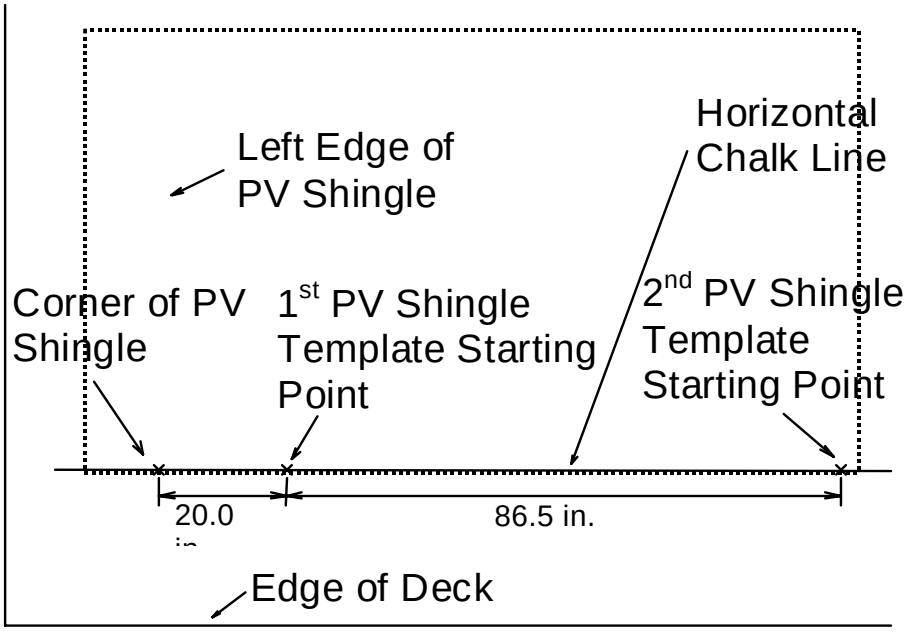


Figure 3

1.6 At each marked position on horizontal line snap a vertical chalk line sufficiently long to mark all rows of PV shingles (see figure 4).

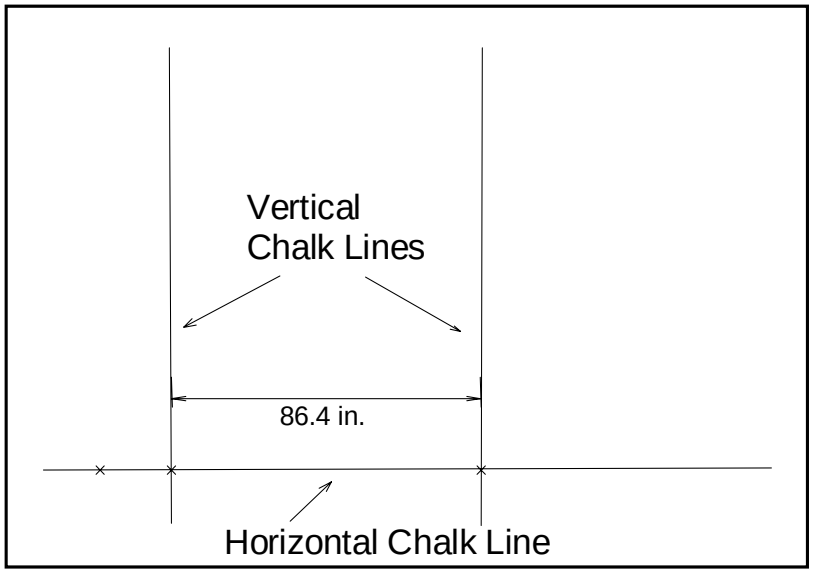


Figure 4

2.0 Positioning and Drilling of Feed-through Holes
Reference figures 4 and 5 for steps 2.1 and 2.2.

2.1 Lay template face up and centered (using centering slots) on first vertical line with the bottom edge along the horizontal line as shown in figure 5. [Cardboard drilling template included in each carton of PV shingles.]

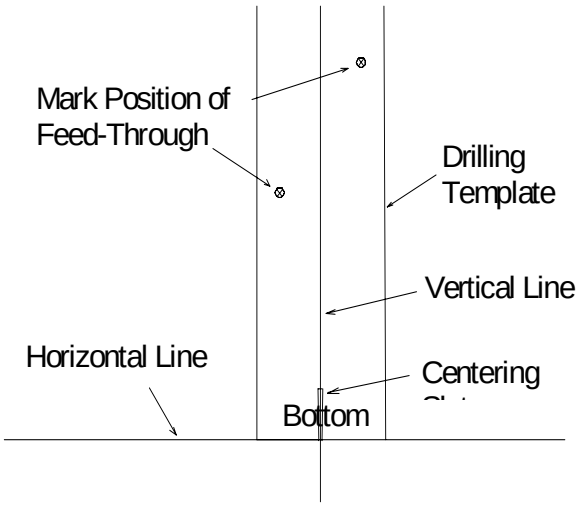


Figure 5

2.2 While holding template firmly in place mark position of feed-through holes, using holes in template, for as many rows of PV shingles as will be installed.

2.3 To mark additional PV shingle feed through holes move the template up on the deck such that the template is still centered on the vertical line with a minimum of two holes of the template overlapping and centered on the previous marked position (see figure 6).

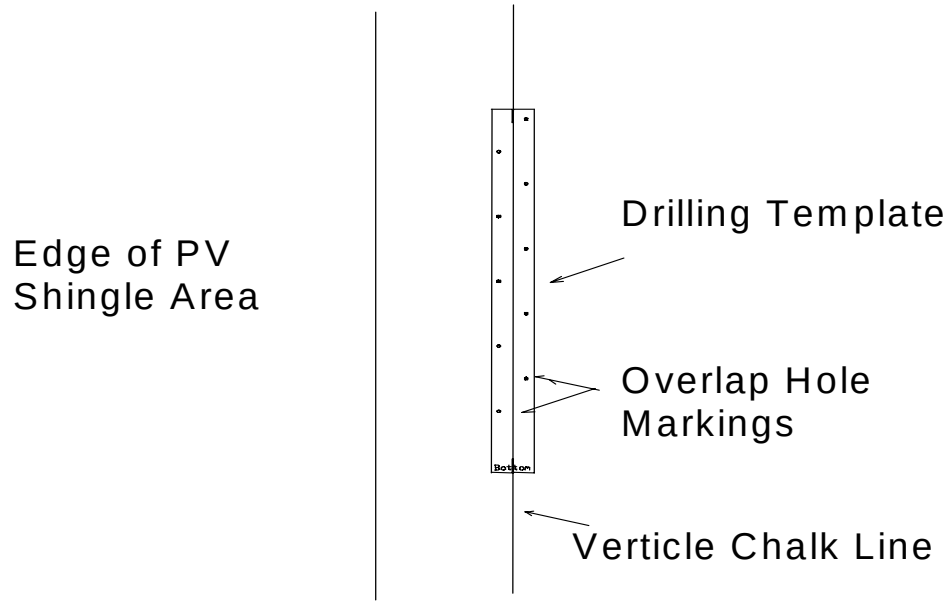


Figure 6

2.4 Continue marking feed-through holes on the same vertical line until there are as many feed-through holes as there are rows of PV shingles.

2.5 Repeat steps 2.2 and 2.3 for each vertical line made in step 1.6.

2.6 Use the piece of 2X4 (other scrap wood) to fabricate a drilling aid. The drilling aid will keep the wood shavings from getting in between the felt paper and the wood deck. To fabricate the drilling aid, use the 7/8-inch drilling bit to drill a hole in the middle of the piece of wood as shown in figure 7. Position the drilling aid over the center of the mark made in steps 2.1 to 2.5. Drill a 7/8-inch hole that will be used to feed wires through. **Note: Avoid rafters under deck. If this is unavoidable, drill through the rafter at an angle so the feed-through wires are able to clear the rafter.**

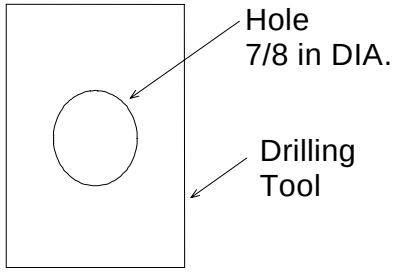


Figure 7

2.7 Repeat step 2.6 for all remaining marks made in steps 2.1 through 2.5 as shown in figure 8.

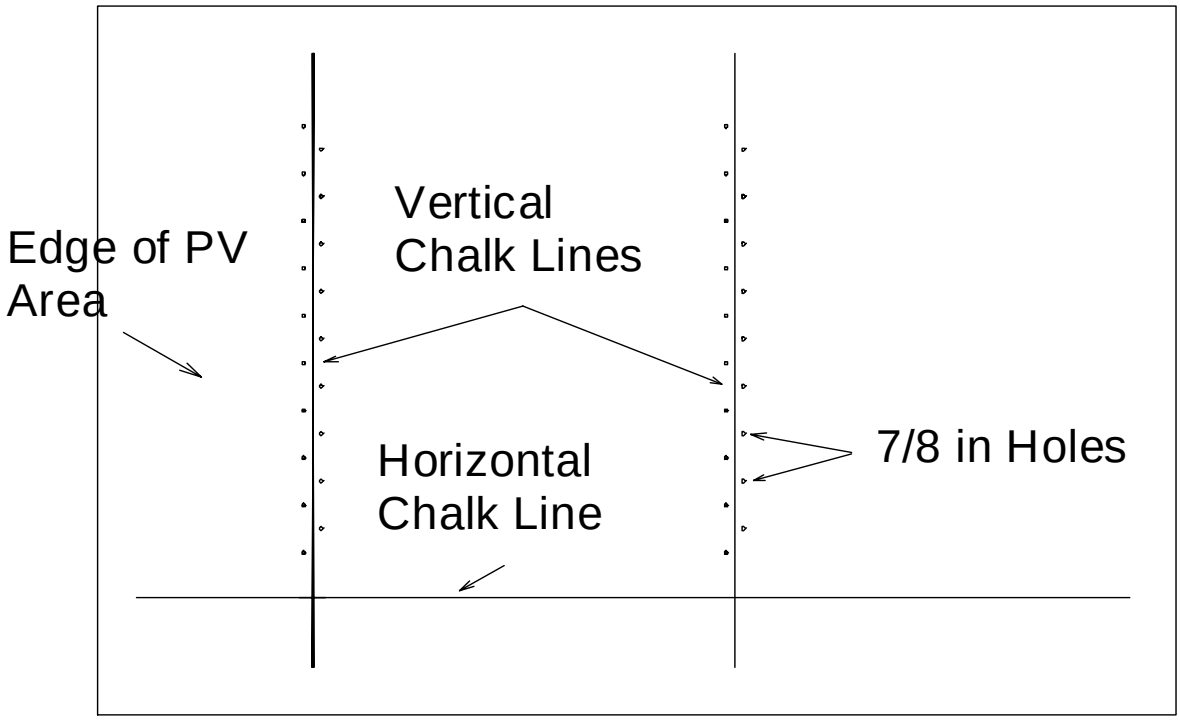


Figure 8

2.8 Remove all shavings produced from drilling in step 2.6 and 2.7.

2.9.1 Layout and install the first asphalt shingles up to the horizontal chalk line as shown in figure 9.

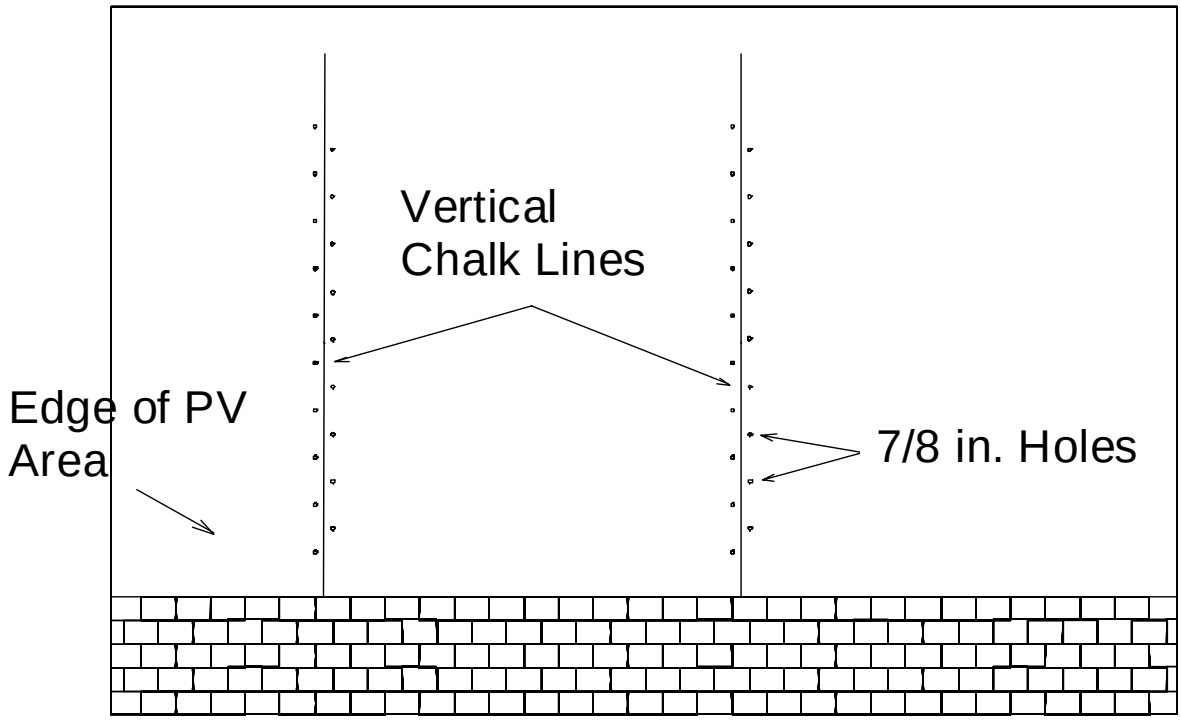


Figure 9

2.10 Snap the original horizontal line again as in step 1.3 (this line should be 9 1/2" below first feed through hole).

3.0 Mounting of Under Deck Raceway

3.1 From under the deck place bottom part of raceway over the drilled holes and mount to the underside of the decking using 1/2" wood screws (see Figure 10). **CAUTION: Be sure that the wood screws do not protrude through the roof as the PV shingle may be damaged, resulting in a potential shock hazard.**

View From Underside of Roof Deck

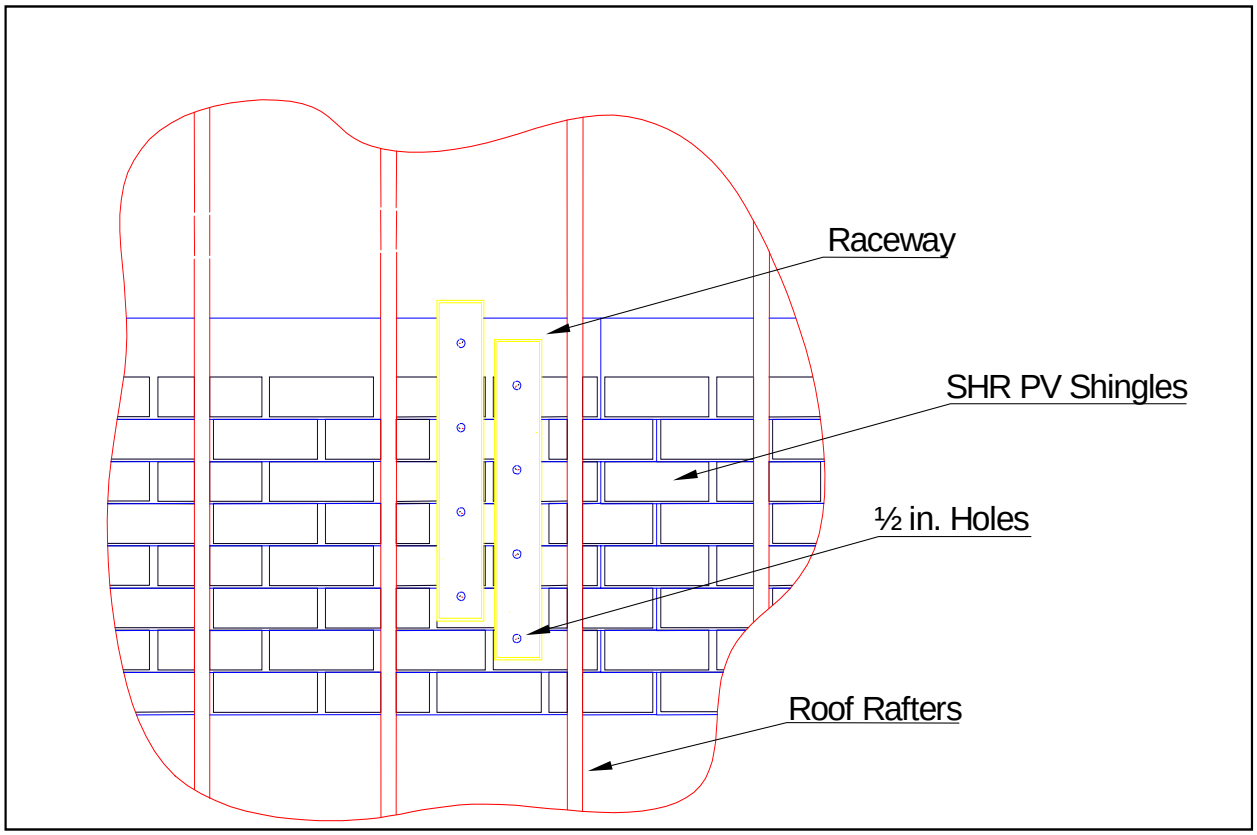


Figure 10.

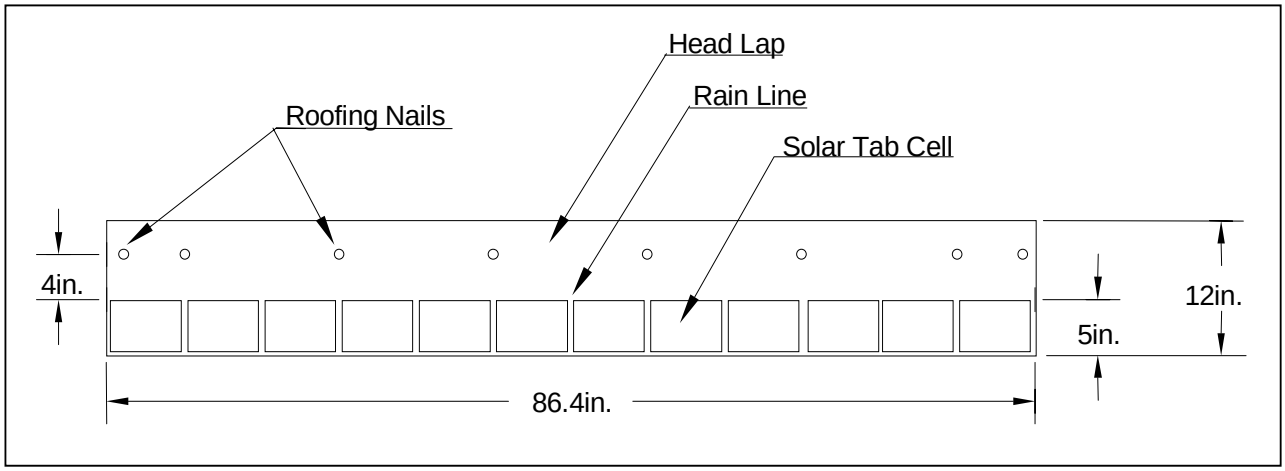
3.2 From the topside of the roof deck, using the existing 7/8" holes previously drilled in the roof deck as a template, drill 1/2" diameter holes through the raceway for shingle wiring. After installing the raceway, place 7/8" OD conduit sleeves (or some other type of grommet that will protect the wires as they are fed through the hole drilled in the roof deck). The conduit sleeves must be cut in lengths to match the thickness of the roofing deck (typically ½" or ¾").

4.0 Location of Fasteners

4.1 The roofing contractor will penetrate the solar shingle in the designated area only (at the Head Lap, 4 inches above the exposed solar cells, while being careful to avoid the wires in the back). Refer to the drawing below for location of the roofing nails (safe places for hardware penetration).

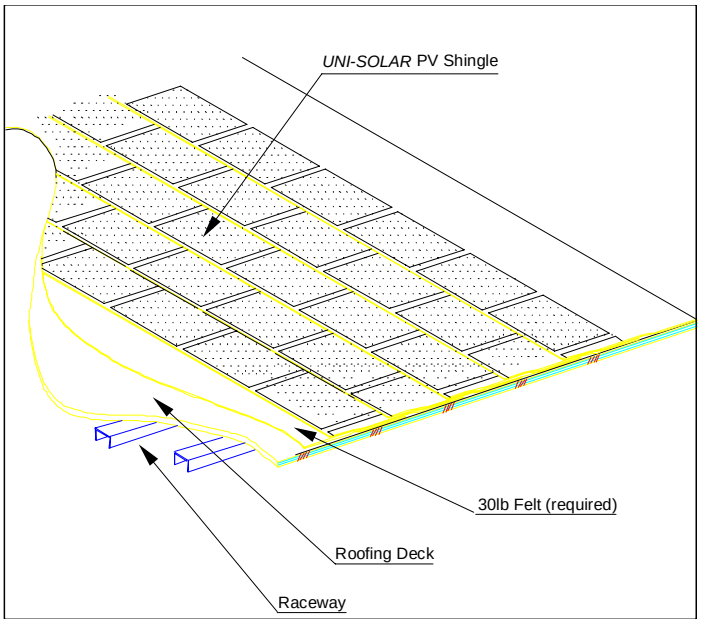
****WARNING****

If the fastener penetrates the Head Lap material too close to the active material of the solar shingle or too close to the bus bar and wire assembly area, there is a possibility that water, dirt, and/or dust could find its way to the active material and corrosion would occur.



5.0 Mounting of PV shingles

5.1 Remove the release paper on the back of the PV shingle near the output wires and along the bottom of the PV shingle.



5.2 Position the first PV shingle in the first row while feeding the wires through the hole as the shingle is placed on the deck (see figure 11).

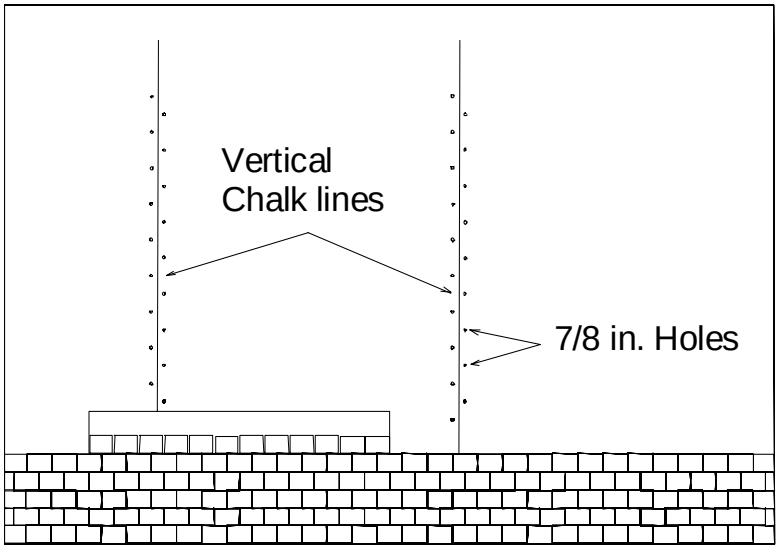


Figure 11

Note: It is very important for the base of the wire (where it goes into the PV shingle) to be completely within the hole so that the PV shingle will lay flat on the deck.

5.3 Align the bottom of the PV shingle with the horizontal chalk line from step 2.10 or the top of the 5 inch (12.7cm) exposure of the previous row of asphalt or PV shingle as shown in figure 11 (if there is no earlier row align with edge of deck).

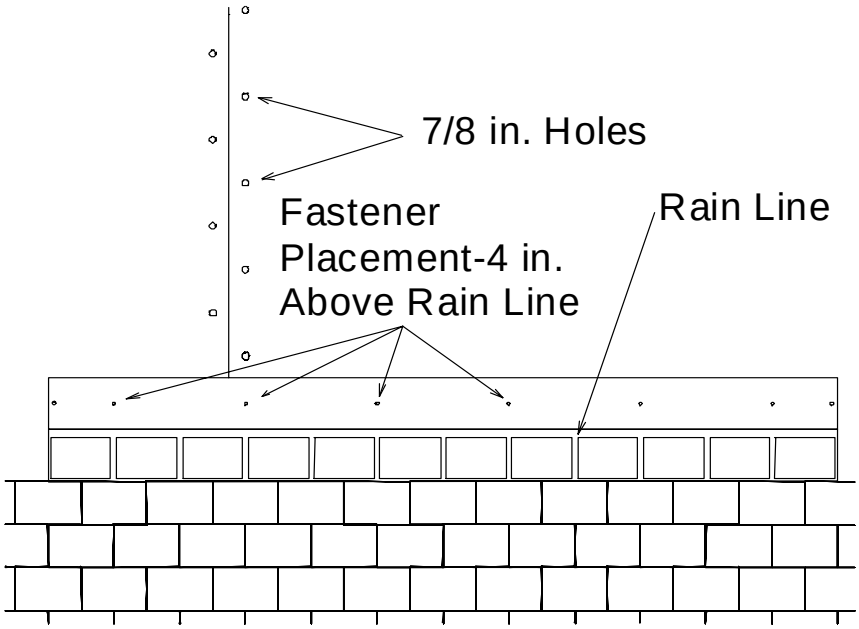


Figure 12

5.4 Fasten PV shingle using 1 1/4 inch (3.2cm) roofing nails 2 rain lines apart and 4 inches (10.2cm) ***directly*** above the rain line as shown in figure 12. **Note: It is important to fasten PV shingle in this area to avoid puncturing electrical components inside the package (see figure 12)**.

5.5 Repeat steps 4.2 through 4.4 for all remaining PV shingles in first row as shown in figure 13.

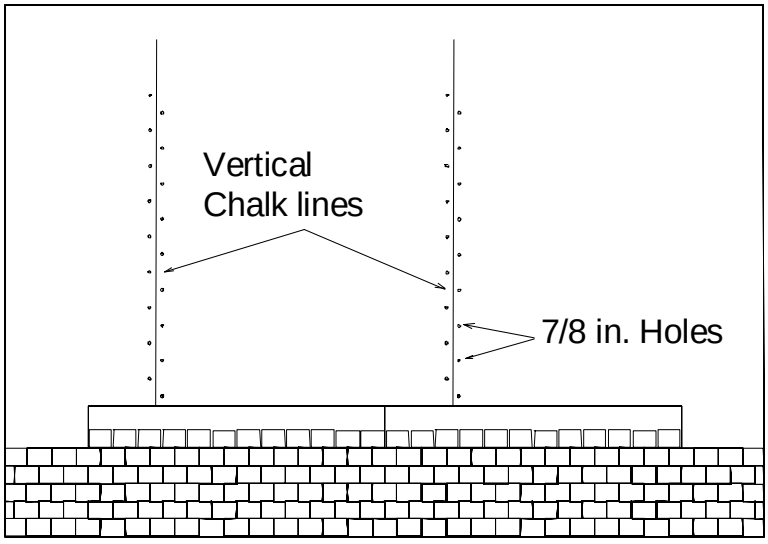


Figure 13

5.6 Finish first row with asphalt shingles installing them in the conventional manner, butting the asphalt to the PV shingle, edge to edge as shown in figure 14.

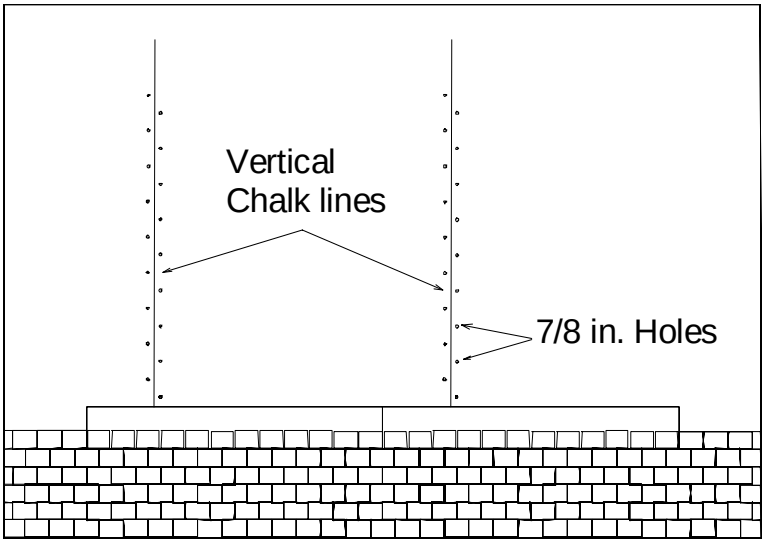


Figure 14

5.7 As in steps 4.2 through 4.4 install first PV shingle in second row with the rain lines staggered by half a tab on the previous row (see figure 15).

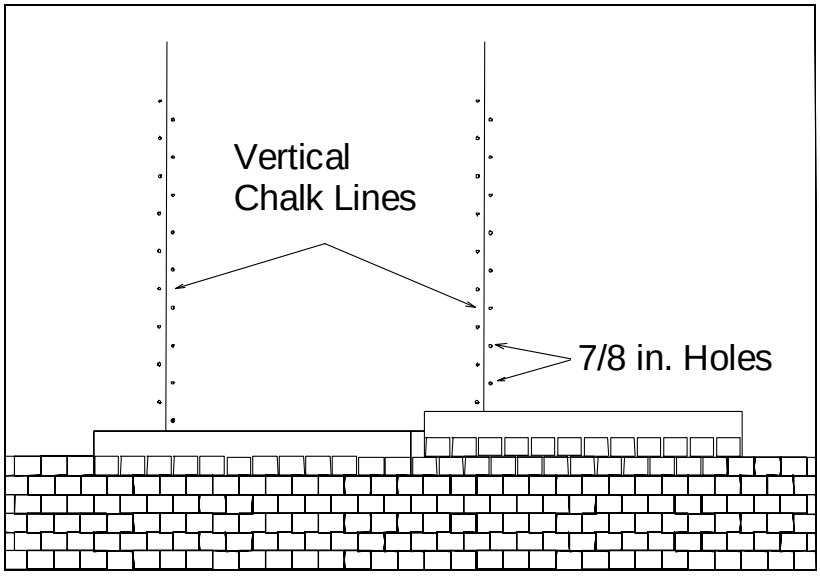


Figure 15

5.8 Repeat steps 4.2 through 4.4 for all remaining PV shingles in the second row as shown in figure 16.

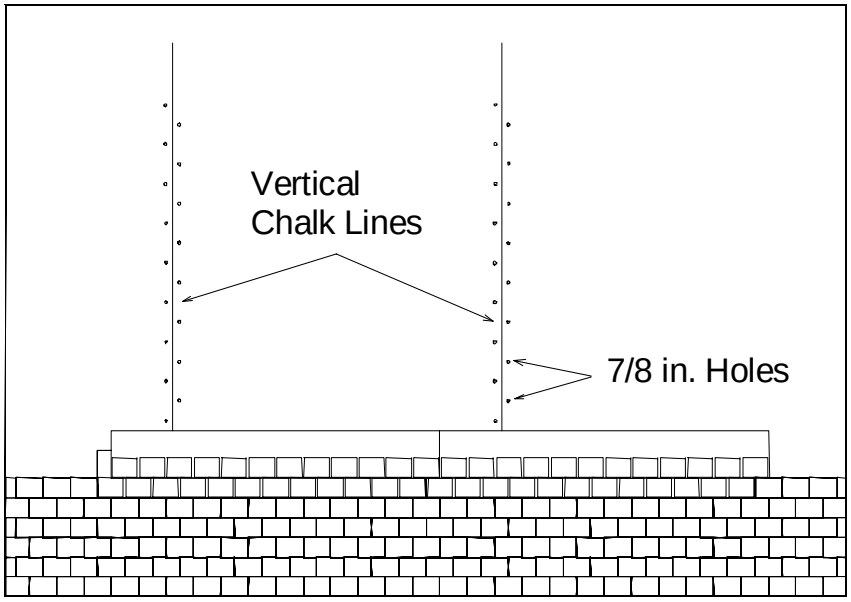


Figure 16

5.9 As in step 5.6 complete the second row with asphalt shingles.

5.10 On one end of each row, starting with the second row, the asphalt shingle will overlap the PV shingle by about 3 1/2". Where this occurs run a bead of polyurethane adhesive onto the PV shingle just above the glossy line (about 1" above exposed area) then press asphalt shingle in place.

5.11 Repeat steps 5.2 through 5.10 for all rows of PV shingles.

6.0 Finishing Deck with Asphalt Shingles

6.1 Install asphalt shingles above the PV shingle array in the conventional manner (see figure 17).

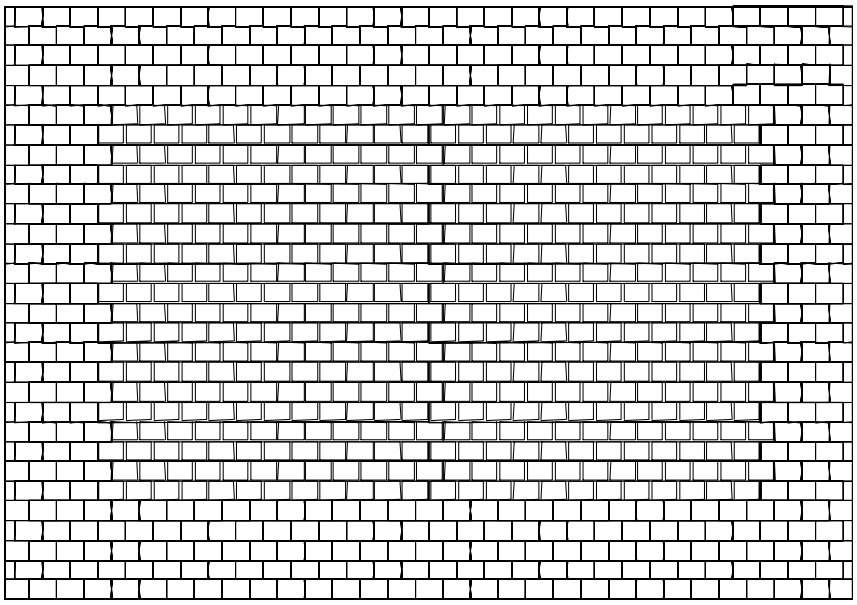


Figure 17

6.2 In the first row of asphalt shingles above the PV shingles use polyurethane adhesive as in step 4.10 to adhere asphalt shingle to the PV shingles.

8.0 Wiring

(NOTE: This Wiring Procedure and wiring components such as non-metallic wire raceway and weather-resistant butt splices are included in the UL listing of the SHR- 17 PV module.)

CAUTION: The PV Shingle is an active electrical power source in sunlight. Consider all electric leads to be "live"

- Each PV shingle has two wires - red is positive and black is negative. Remove protective tape or strip the wire ends as necessary prior to interconnecting the PV shingles. Wiring of the PV shingles to form a complete solar electric "array" involves connecting PV shingles in series to form "string" circuits that are combined (paralleled) in a separate junction box. No parallel wiring of PV shingles is to occur in the raceway beneath the shingles.

Tools Needed:

- Stripper, Crimp tool (for butt splice connectors), diagonal cutter

- From under the deck, connect PV shingles in series (2, 4 or 7 typical) for the sired circuit voltage (see table 1) and system design. PV shingles are interconnected using a "butt splice connector" and high quality crimp tool. See attached drawing no SHR-001 for an example wiring detail.

Table 1

Nominal System Voltage	Number of PV Shingles In Series	Open Circuit Voltage	Operating Voltage
12	2	26	18
24	4	52	36
48	7	91	63
275-550	35-42	455-550	315-378

9.0 Maximum Voltage and Grounding

- *UNI-SOLAR*® roofing shingles are suitable for use in systems where system voltages do not exceed 600 volts. The panels can be wired in series, parallel or a combination of both to meet system load requirements. When modules are wired in series, the volts will add up while the amps remain the same. When modules are wired in parallel, the amps will add up while the volts remain the same. By combining series and parallel wiring, any requirement can be met. **Do not use *UNI-SOLAR*® roofing shingles in systems having a maximum open circuit voltage greater than 600 volts DC.**

- Section 690.5 of the NEC requires that systems with PV modules on the roof of a dwelling have ground fault protection equipment. The Xantrex GFP-1 and GFP-4 are ground-fault protection devices that meet these requirements.

- An equipment-grounding conductor will need to be attached to a ground rod. The conductor can be bare or insulated with green colored insulation. The conductor should be sized according to Table 250-122 in the 2002 NEC. There will be no “equipment ground” attached to the solar shingles.

10.0 Information Concerning PV System Installation

Roof Requirements

The modules should be mounted on an area of roof deck with maximum exposure to sunlight that is devoid of vents, air conditioners or any other obstructions that may shade the solar modules during the day or complicate the installation. Ideally the roof will face south in the Northern Hemisphere and north in the Southern Hemisphere. If the roof face is within 15 degrees of true south (in the Northern Hemisphere), there will be no substantial loss of power. If, however, the roof face is more than 15 degrees away from true south, the array will not perform at peak efficiency. For example, if the roof is facing due east, power output will be reduced by ~20%. The slope of the roof will also affect solar array output. For maximum annual output, the angle of the roof slope should be at the area's latitude -10 degrees. For maximum wintertime performance, the roof slope should be at the area's latitude +10 degrees.

Aesthetics

UNI-SOLAR® roofing systems consist of a flexible, ETFE encapsulated solar shingles attached to a roof deck. The color of the solar cell is a deep blue. The color of the standard shingles (which are weaved into the block of solar shingles on the roof) can be chosen from a wide variety of colors, either to blend or contrast with the solar shingles.

Placement of BOS Components

The two most important factors to consider when mounting solar array combiner boxes and BOS components are environmental conditions and distance from the solar modules and batteries (when used.) The system designer must consider whether the components will be mounted outdoors or indoors. Factors such as proximity to a dirt road (large amounts of dust) or the sea (salt-water corrosion) must be considered. If conditions are especially harsh, more expensive enclosures must be used. If components will be mounted indoors, less expensive enclosures can be used.

The distance between the solar modules, the combiner boxes and the BOS will affect wire size and layout. Wire costs increase as the length and size of the wire increase so it is best if the solar modules are as close as possible to the BOS components. If it is not possible to decrease the distance from the modules to the BOS, system voltage is usually increased (e.g. to 48 VDC) to decrease the amps and consequently reduce the wire size and costs. Combiner boxes are usually mounted close to the array, commonly in the attic or by the inverter. With outdoor installations, they are often mounted directly under the array.

Orientation:
Refers to the direction the modules will face after you have attached them to the roof. In the Northern Hemisphere (United States, Central America, Europe, India, Japan) the roof should face to the South. In the Southern Hemisphere (most of South America,

South Africa, Australia), the roof should face to the North. If your modules are not facing "true" South, that's OK. However, if you are more than 20 degrees off of South, there will be some measurable loss of power.

Tilt angle:
Refers to the tilt of the solar modules up from horizontal (flat on the ground). You cannot adjust the tilt angle of the roof in most cases so the tilt angle of the roof becomes the tilt angle of the *UNI-SOLAR* PV Shingles. Ideally, the tilt angle of your roof will match your latitude or your latitude –10 degrees. For example, if you were at North Latitude 40 degrees, the ideal tilt angle would be 30 degrees from horizontal (i.e. a roof pitch of ~8/12) for maximum annual electrical production from the solar array.

9.0 Maintenance

- Periodically check module wire connections for tightness and corrosion. The best time to check is just before and/or just after the winter (or rainy) season.

- Generally, a good rain is sufficient to clean the PV roofing shingles. However, in dusty arid locations the PV roofing shingles can be cleaned with mild soap and water. Do not use abrasive soaps or solvents.

- Do not spray water directly at leading edge of the PV roofing shingle. Use caution when cleaning PV roofing shingles, as the combination of water and electricity may present a shock hazard. Avoid cleaning the solar shingles in the middle of the day.

- When working on the solar shingles, always wear electrical gloves, disconnect all energy sources (i.e. battery and/or utility) and short-circuit the output of the PV roofing shingles.

- ***Balance of System (BOS) Components***

- With disconnect switches closed, record all system meters and status indicators.

- With the multi-meter, check array and battery voltage (check current between controller and battery if you have a clamp-on amp meter).

- Check for open circuit breakers or blown fuses.

- Open disconnect switches and use your multi-meter to **confirm that the power is actually cut off.**

- Check for loose wires or connections at the solar system controller (voltage regulator).

- Remove cabinet covers and visually inspect all equipment wiring.
- Close all disconnect switches and make sure loads are operating as designed.
- Clean and lubricate loads as required.
- Confirm that no new loads have been added to the system and that loads are operating for the specified number of hours per day.

UNI-SOLAR® Photovoltaic Products Limited Warranty

Product Class	**Roofing Laminates**	**Roofing Shingle**	**Framed Modules**	**Framed Modules**
Series	PVL-29-136	SHR-17	ES62, 124 US32-116	US5-21
Warranty Period	20 years	20 years	20 years	10 years
Conditions	A	D	B	C

Conditions: (General conditions apply to all products listed on this statement)

Condition A: PV laminates or shingles which upon inspection by United Solar Ovonic or its appointed agent exhibit a power output of less than 80% of the Rated Power (@STC) specified at the time of sale, as measured at the Quick Connect or Junction Box output terminals, due to defects in materials or workmanship of PV Shingles, or PV Laminate bonded to certified steel[1] will, at the option of United Solar Ovonic be repaired or replaced, or, United Solar Ovonic will refund an amount equal to lost power times the amount paid for the module per watt of Rated Power. Lost power is the difference between the exhibited power and 80% of the Rated Power of the PV Laminates or shingles, both at Standard Test Conditions. This warranty does not apply to any PV laminates that have been applied to non-certified steel, and/or without strict adherence to installation procedures outlined in the current version of UNITED-SOLAR "Field Applied PV Laminates Installation Guide for Steel Roof Systems."

Condition B: Framed modules which upon inspection by United Solar Ovonic or its appointed agent exhibit a power output of less than 80% of the Rated Power (@STC) specified at the time of sale, as measured at the Junction Box output terminals, due to defects in materials or manufacturing workmanship of the PV module will, at the option of United Solar Ovonic, be repaired or replaced, or, United Solar Ovonic will refund an amount equal to lost power times the amount paid for the module per watt of Rated Power. Lost power is the difference between exhibited power and 80% of the Rated Power both at Standard Test Conditions.

Condition C: Framed or Flexible modules which upon inspection by United Solar Ovonic or its appointed agent exhibit a power output of less than 80% of the Rated Power (@STC) specified at the time of sale, as measured at the Junction Box output terminals, due to defects in materials or manufacturing workmanship of the PV module will, at the option of United Solar Ovonic, be repaired or replaced, or, United Solar Ovonic will refund an amount equal to lost power times the amount paid for

the module per watt of Rated Power. Lost power is the difference between exhibited power and 90% of the Rated Power both at Standard Test Conditions.

General:

All warranty periods begin from the date of sale to the original purchaser. This warranty does not apply to any PV Laminates or Modules which, in the judgment of United Solar Ovonic, have been subject to misuse, neglect, or accident or which have been damaged through abuse, alteration, improper installation, or application, or negligence in use, storage, transportation or handling, or repaired by anyone other than United Solar Ovonic. The warranty does not cover any transportation costs for return of Modules or for reshipment of any repaired Module, or costs associated with installation, removal or reinstallation of Modules.

United Solar Ovonic shall have no responsibility for damage to person or property or other loss or injury resulting from defect in laminate or from improper use or installation. Under no circumstances will United Solar Ovonic be liable for any incidental or consequential damage. Any warranties implied by law, including those of merchantability and fitness for a particular purpose are hereby expressly disclaimed. This warranty is in lieu of all other warranties, expressed or implied. The purchaser's exclusive remedy shall be only stated herein.

The factory will not accept the return of any PV Roofing Laminate or Framed Modules unless United Solar Ovonic has given prior written authorization in the form of an issued Return Material Authorization (RMA).

To obtain a RMA # please contact:

Customer Service Warranty Claims
United Solar Ovonic
(248) 475-0100 Phone
(248) 362-0510 Fax

Notes:
[1] Certified Steel: Stainless Steel or Zinc-Aluminium galvanized steel pan (Galvalume®AZ50, AZ55, AZ60 or Zincalume® AZ150) coated with Kynar®500 or Hylar®5000 PVDF coating.

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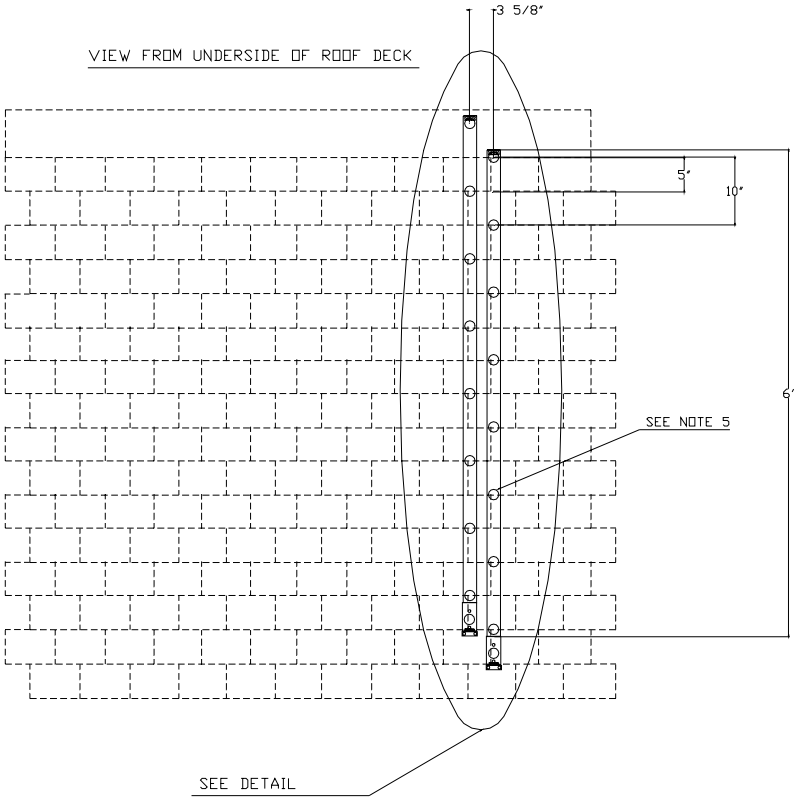
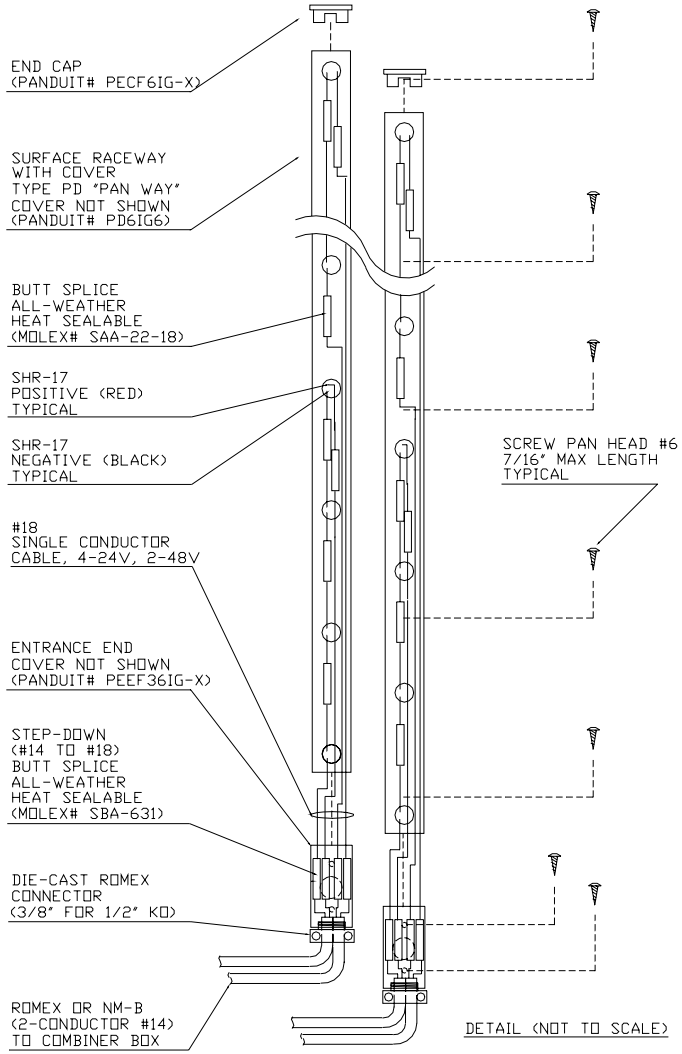
NOTES
1. DEATIL DEPICTS 24V CONFIGURATION (4 SHRs WIRED IN SERIES).
2. FOR 24V, EACH 6' LENGTH OF RACEWAY CONTAIN TWO SOURCE CIRCUITS (AS SHOWN).
3. FOR 48V, EACH 6' LENGTH OF RACEWAY WOULD CONTAIN ONE SOURCE CIRCUIT (7 SHR MODULES).
4. DRAWING DEPICTS RACEWAY LAYOUT FOR 16 SHR-17 SHINGLES.
5. INSERT CONDUIT SLEEVES IN EACH FEED-THROUGH HOLE DRILLED INTO THE ROOF DECK.





Underwriters Laboratory
File # E182242
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