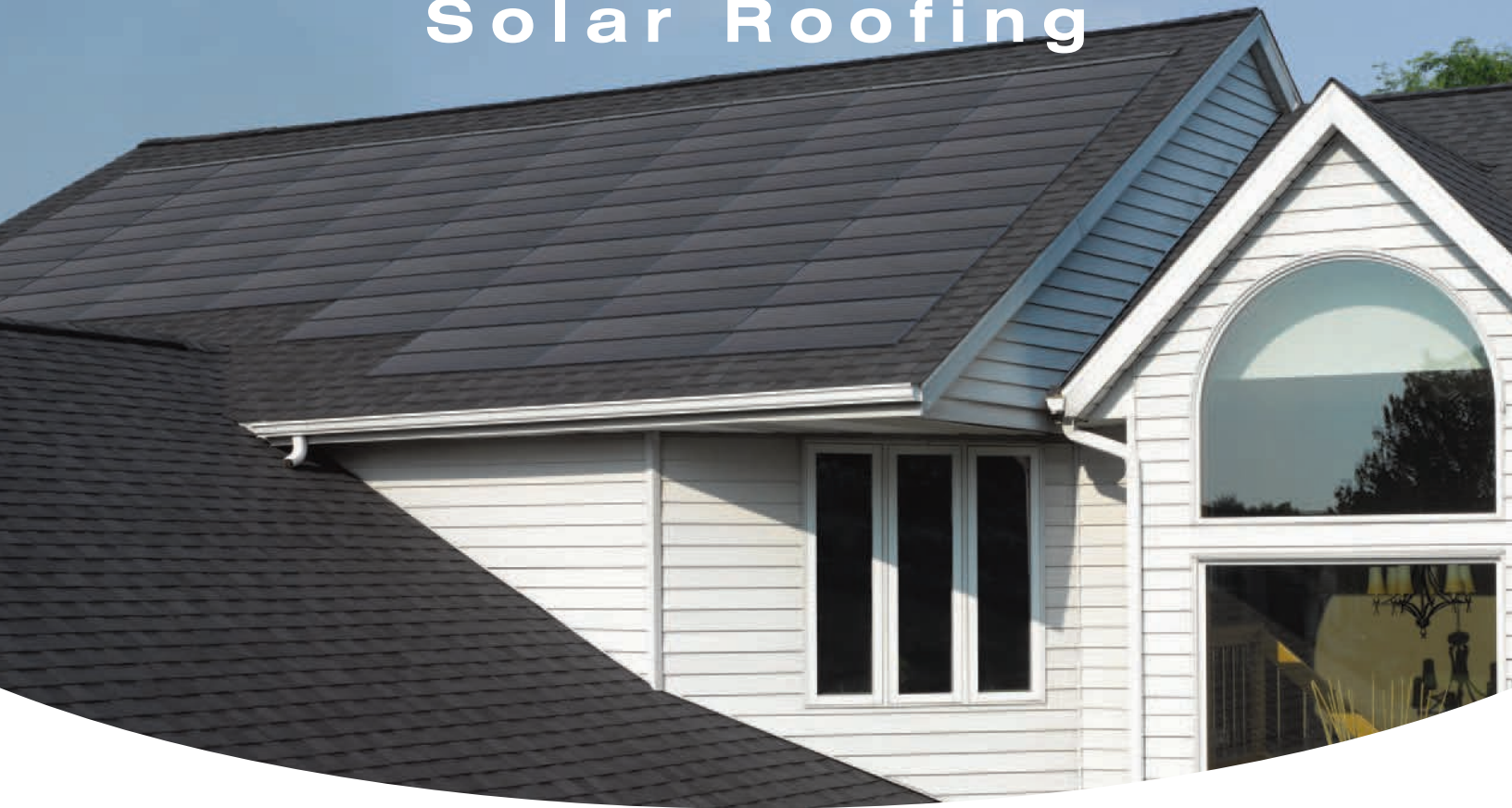


**APOLLO II™**

**Solar Roofing**



# Installation Instructions

**CertainTeed**  
SAINT-GOBAIN

**Solar**



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## Apollo II™ Installation Instructions Key



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### **NOTE**

Used to remind the contractor of a step or action or make a particular step or action easier for the contractor

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### **IMPORTANT**

Used to denote steps or actions critical to proper installation

---



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### **CAUTION**

Used to denote steps or actions critical to prevent damage to the system or property

---



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### **WARNING!**

Used to denote steps or actions critical to health and safety

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## Safety Precautions

- An Apollo II™ System must be installed by a trained installer. Potentially dangerous electrical voltage is present in Apollo II™ PV Shingles and system components. The installer must be familiar with appropriate safety procedures for handling electricity and must wear appropriate Personal Protective Equipment (PPE).
- Apollo II™ PV Shingles do not have an "On/Off" switch and generate electricity when exposed to any light source. The shock hazard from the PV Shingles increases when the panels are connected in series. Do not touch live terminals with bare hands or any conductive material. The only way to make PV Shingles inactive is to remove them from any light source and/or cover the front of the PV Shingle with an opaque material.
- Prior to conducting maintenance or cleaning Apollo II™ PV Shingles check the panel display of the inverter. If it indicates a "Ground Fault Error", do not clean or conduct maintenance. Immediately contact a qualified electrician or qualified installer.
- **DO NOT** connect or disconnect Apollo II™ PV Shingle connectors when the inverter is under load or operating.
- **DO NOT** redirect or concentrate sunlight or artificial light onto Apollo II™ PV Shingles.
- Apollo II™ PV Shingles may be walked on when properly installed. However, extreme care must be taken. The surface of the PV Shingle presents a slip hazard, especially when wet. The panel surface can also be damaged by abrasion from small stones and other debris. Only trained roofing personnel should walk on the PV Shingles. Appropriate Personal Protective Equipment (PPE) must be worn at all times. Refer to CertainTeed's Shingle Applicator's Manual for additional roofing-specific safety guidelines.
- Under normal conditions, the Apollo II™ PV Shingle is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current capabilities, fuse sizes, and size of controls connected to the photovoltaic output.

Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent de-rating), which may be applicable. See Apollo II™ PV Shingles' labels for specific electrical ratings. These electrical characteristics are within +/-3 percent of the indicated values of Isc, Voc, and Pmax, under standard test conditions (irradiance of 1000 W/m<sup>2</sup>, AM 1.5 spectrum, and a cell temperature of 25°C (77°F)).

- Apollo II™ may allow snow to slide off a roof easily, and therefore the use of snow guards **below the array** is highly recommended in all applications where snow is a concern. The risk of snow sliding off a roof increases in areas with above-average snowfall, and the use of snow guards is particularly important in such areas. The installation contractor should refer to local building codes and requirements for the use of snow guards and should follow the snow guard manufacturer's instructions for correct spacing and application.

## Installation Limitations

- Apollo II™ is designed to be installed on pitched roofs with slopes of 4:12 or greater. **DO NOT** install on slopes lower than 4:12.
- The roof deck must be a minimum of 15/32" veneer plywood, 7/16" non-veneer APA rated sheathing panel (oriented strand board panels, structural particleboard panels, composite panels or wafer-board panels) or 3/4" thick wood sheathing boards.
- Apollo II™ may only be installed in new construction or in a retrofit roof. **DO NOT** install Apollo II™ over an existing roof system.
- Apollo II™ PV Shingles must not be installed over any roof projections, plumbing or attic vents. Vent pipes/stacks may be moved to an alternate location in order to accommodate a continuous solar array. **DO NOT** attempt to cut or modify the PV Shingle.
- Apollo II™ PV Shingles must not be installed within 14 inches of the perimeter of the roof to allow enough space to install appropriate underlayment and flashing for the system. Consult your local Authority Having Jurisdiction (AHJ) to determine if further setbacks are required.
- The installer should check for pre-existing conditions that could affect the installation of a finished system. Examples include, but are not limited to, formation of ice dams in the winter, attic ventilation issues, etc. These items should be resolved prior to installing the Apollo II™ System.

## Installation Requirements

- Only contractors trained on the installation of the Apollo II™ system are permitted to install the Apollo II™ system.
- Only licensed electricians are permitted to install electrical components.
- Read the *Apollo II™ Installation Instructions* and *Inverter Installation and Operations Manual* in their entirety before attempting to install an Apollo II™ system.
- Attic ventilation is required and must meet or exceed current HUD standards.
- Follow all related shingle manufacturer's instructions and standard trade practices.
- Ensure that required roofing and electrical permit(s) and inspections have been obtained from local authorities. Supplying installation specifics will assist the code official in understanding the application.

- Ensure approval for grid interconnection from the local power company.
- Installation of the Apollo II™ PV Shingles must be performed in compliance with all applicable building and safety codes, both local and national which include, but are not limited to, the National Electric Code, local codes and requirements and utility interconnection requirements. Non-compliance with applicable building and electrical codes, ordinances, and regulations may void the warranty.

## Recommended Tools and Materials

The following tools are needed to properly install the Apollo II System:

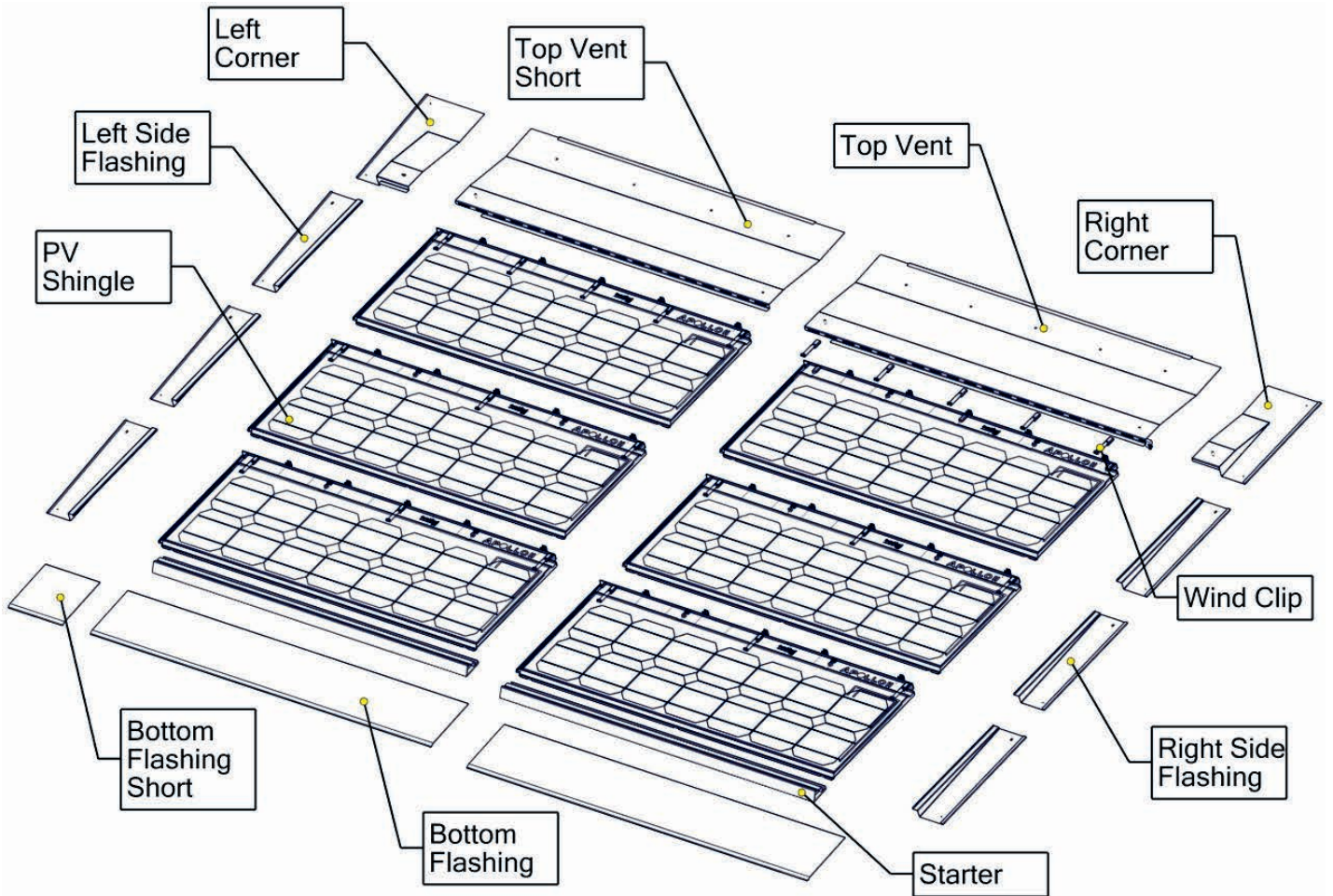
- Tape Measure
- Chalk Line
- Utility Knife
- Digital multi-meter
- Cordless drill
- 1-3/8" Hole saw/ spade bit (roof deck penetration)
- ¼" drill bit (grounding lug)
- Standard screwdriver (grounding lug)
- 3/8" Wrench (grounding lug)
- Torque wrench (bonding locknut)

A standard selection of roofing hand tools is necessary to complete the installation of asphalt shingles surrounding the Apollo II System.

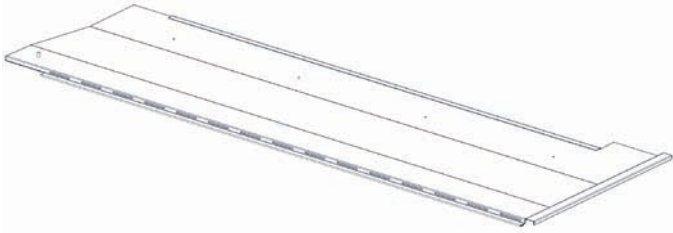
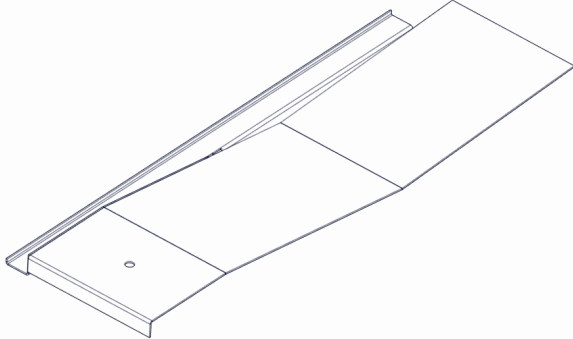
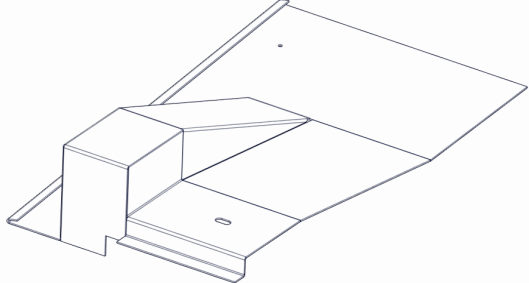
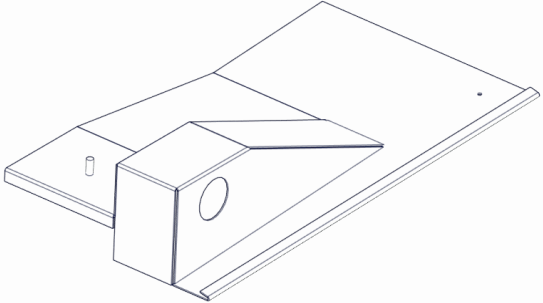
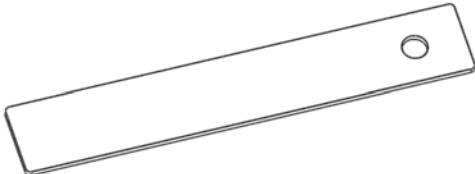
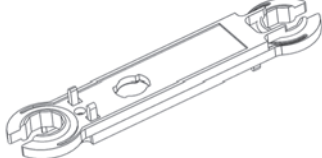
The following materials must be provided by the installer. This list is representative only, and additional materials may be required depending on the installation.

- High quality elastomeric, urethane, or roofing mastic which meets ASTM D4586 Type II
- Snow guards, where required
- Wiring, conduit, enclosures, disconnects from roof penetration down through the house
- An equipment ground is required to ground the flashing above the PV Array. Wire gauge will depend on site specific variables and should always be chosen in accordance with local and national electrical codes. Overall length will depend on the size and configuration of the array.
- #10 corrosion resistant screws [corrosion resistance equivalent to ASTM A641, Class A]
  - 1-1/4" minimum fully threaded screws for Flashing and Starter
  - 1-3/4" minimum screws for PV Shingles

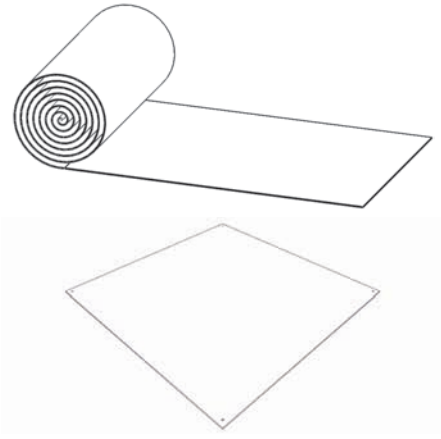



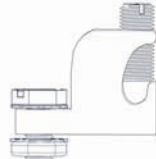

# System Overview



## Additional Parts (not shown in System Overview)

|                                   |  |
|-----------------------------------|--|
| Left Inside Corner Flashing       |  A long, thin metal flashing with a bent end, designed for installation in a left inside corner.   |
| Right Inside Corner Flashing      |  A long, thin metal flashing with a bent end, designed for installation in a right inside corner.  |
| Left Top Corner Conduit Flashing  |  A metal flashing with a complex shape, including a vertical flange and a horizontal base, designed for a left top corner with a conduit.   |
| Right Top Corner Conduit Flashing |  A metal flashing with a complex shape, including a vertical flange and a horizontal base, designed for a right top corner with a conduit. |
| Gap Spacer                        |  A long, thin metal spacer with a circular hole at one end, used to maintain a consistent gap between panels.                              |
| PV Connector Key                  |  A metal key with a circular hole and a complex end, used to secure PV connectors.   |



|   |  |
|---|--|
| <p><b>Underlayment(s)</b><br/>         CertainTeed PVLayment (Fire Class C)<br/>         FR Underlayment (Fire Class A)</p> |    |
| <p><b>Bonding Locknut</b></p>   |   |
| <p><b>Safety Labels</b></p>   |   |
| <p><b>Penetration Bushing</b><br/>         -Chase nipple<br/>         -Reducing Washer<br/>         -Coupling</p>           |  |
| <p><b>Ground Lug</b></p>  |  |
| <p><b>Extension (~46" length)</b><br/> <b>Homerun Wire (misc. lengths)</b></p>  |  |

## Prior to Installing Apollo II™ System

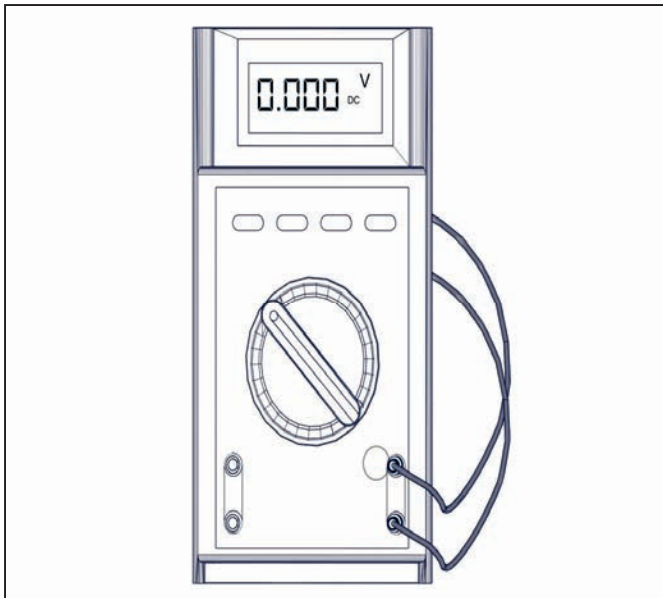
1. Read the Apollo II™ Installation Manual in its entirety.
2. Ensure that all materials are on site.
3. Review the system design and layout. The **System Layout**, based on measurements of the available roof space, shows the approximate physical location of the PV Shingles on the roof. **The roofing contractor is responsible for laying out the array such that it fits the actual roof on site.** If obstructions are present, these should be moved and all penetrations and openings properly sealed before installing the array.
4. Have your electrician prepare a **Stringing Diagram** based on your **System Layout**. A **Stringing Diagram** shows how the PV Shingles in an array will be connected in series strings. Each string is a separate circuit with two Homerun Wires - one positive and one negative. An example is shown in **Appendix A**.



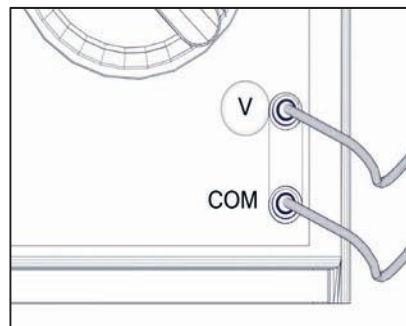
### WARNING

Deviating from your electrician's **Stringing Diagram** will void the warranty and may result in property damage or bodily injury.

5. Based on the **System Layout**, determine where the system will be located. Snap chalk lines as necessary to mark the appropriate areas.
6. Verify that each Apollo II™ PV Shingle voltage (V) approximates the *Open Circuit Voltage (Voc)* specified in the **Technical Data Sheet**. Because voltage decreases with decreased availability of light, it is best to perform this test in full sunlight. Other conditions in the field may cause the voltage to vary. Generally if the measured voltage is within 10% of the specified voltage, the PV Shingle is acceptable.

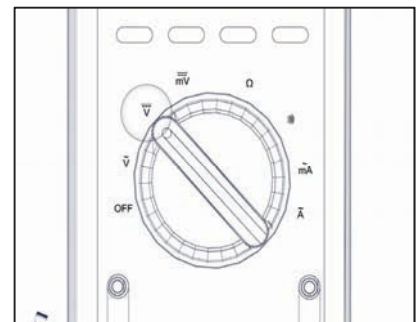


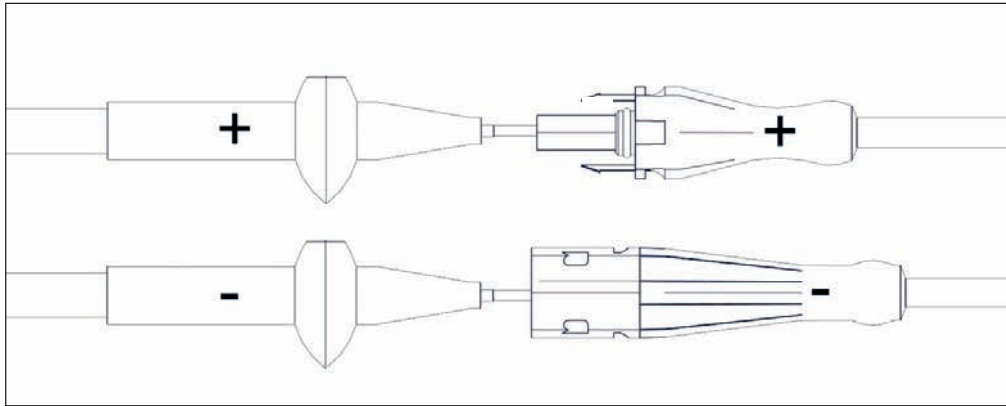
Set up Multi-Meter



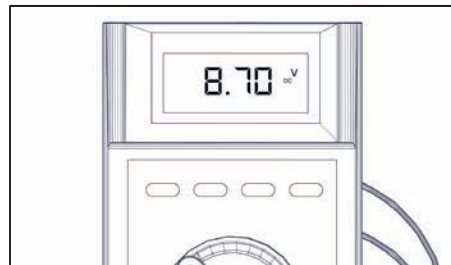
1. Insert leads into correct ports

2. Set dial to DC Volts





Insert probes into Apollo II™ connectors



Read voltage & verify against *Open Circuit Voltage (Voc)* in *Appendix B*

## Apollo II™ Fire Rating

Apollo II™ PV Shingles have a Class C Fire Rating when installed over one layer of **PVLayment**.

Apollo II™ PV Shingles have a Class A Fire Rating when installed over one layer of **PVLayment** and one layer of **FR Underlayment**.

---

### **IMPORTANT**



Failure to properly install the underlayment(s) may result in the loss of the system's Fire Class Rating. Any substitution of underlayments will void the warranty and may result in the loss of the system's Fire Class Rating.

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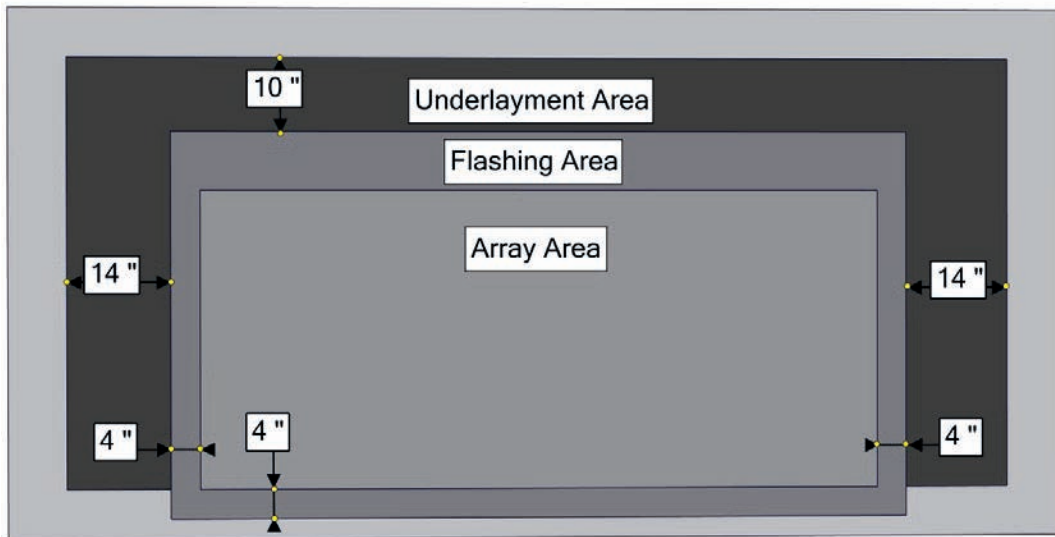
## Installing the Apollo II™ System

For a new construction application, proceed directly to **STEP 1**.

For a retrofit application, remove all existing roofing materials, including underlayment, shingle nails, and any other materials within the *Underlayment Area* until a clean, smooth, dry roof deck is reached. Replace deck materials if necessary to ensure the roof deck is flat.

## STEP 1 - Plan

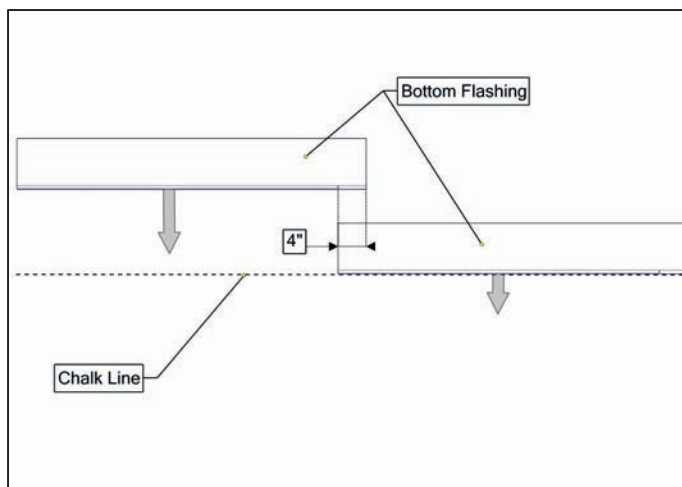
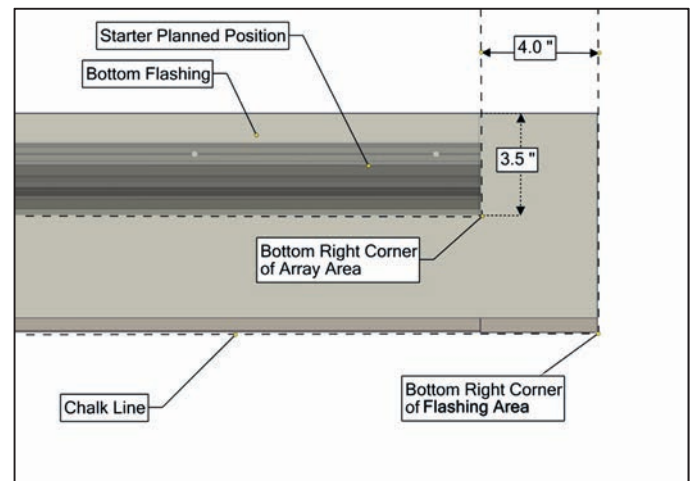
Determine the location of the Apollo II™ array [Array Area] and plan where the *Underlayment Area* will be located per the diagram below. Use chalk lines to plan and indicate the position of the *Array Area* and *Flashing Area*.



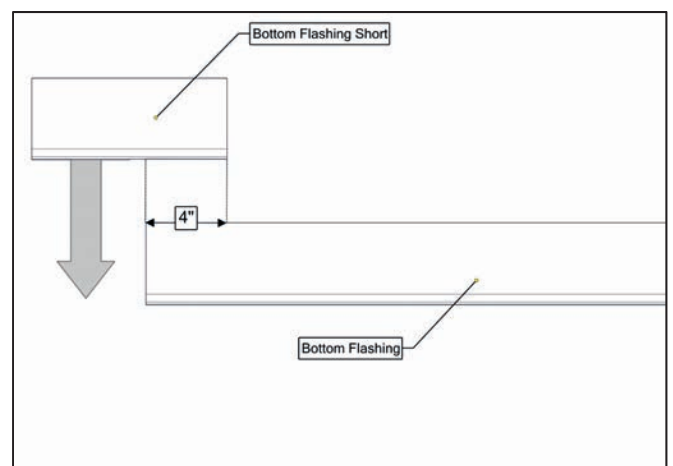
## STEP 2 - Install Bottom Flashing

Starting at the bottom right corner of the *Flashing Area*, position the **Bottom Flashing** as shown.

Fasten the first **Bottom Flashing** in place using four (4) fasteners in the top 1" only.



Moving from right to left, install **Bottom Flashing** pieces so that each new piece overlaps the previous one by 4".



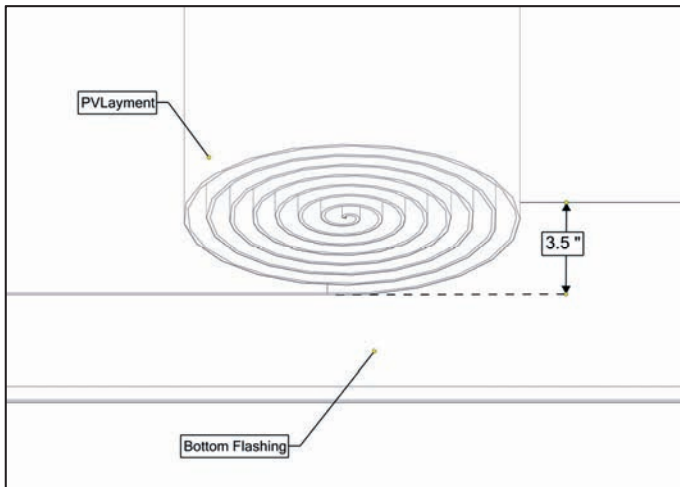
Install the **Bottom Flashing Short** piece so that it overlaps the final **Bottom Flashing** piece by 4".

### STEP 3 - Apply PV Layment



#### IMPORTANT

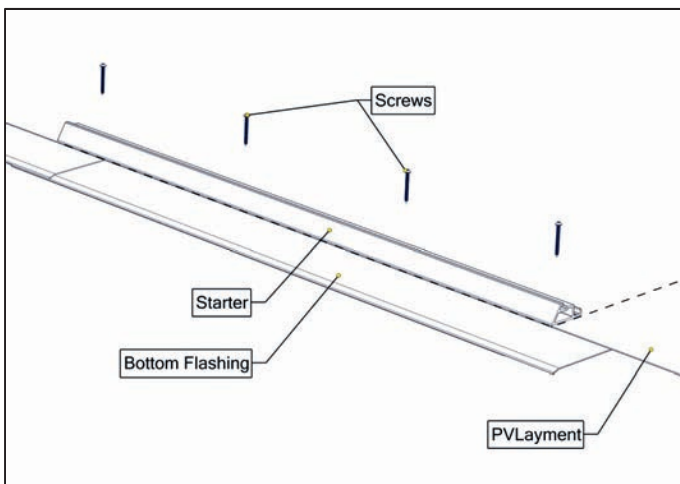
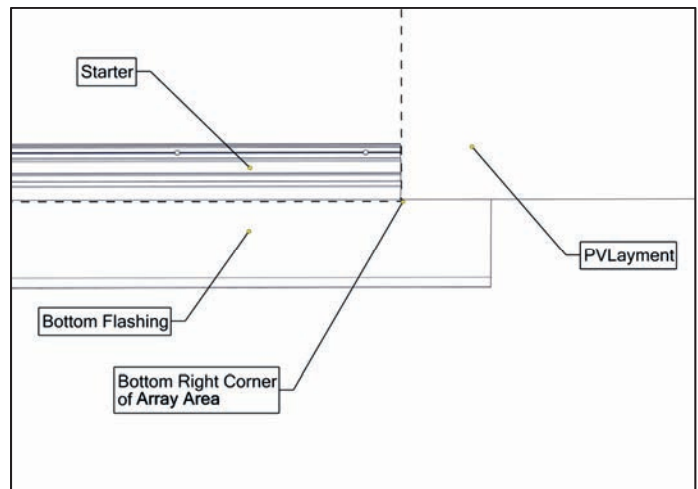
Ensure that the roof deck in the *Underlayment Area* is clean, smooth, dry and free of any debris.



Install **PV Layment** so that it covers the top 3.5" of the **Bottom Flashing**. Continue installing the **PV Layment** using a 6" overlap at the vertical seams and a 3" overlap at the horizontal seams. Cover the entire *Underlayment Area*.

### STEP 4 - Install the Starter Strip

Starting at the bottom right corner of the *Array Area*, position the first **Starter** flush with the bottom edge of the PV Layment.



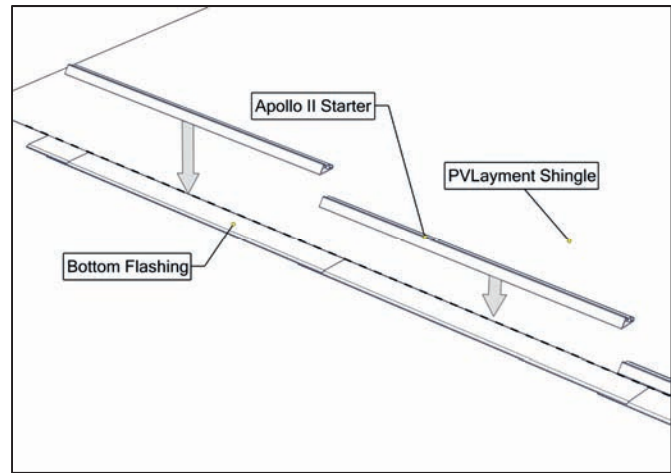
Install the first **Starter** using four (4) 1-1/4" fully threaded screws in the holes provided.



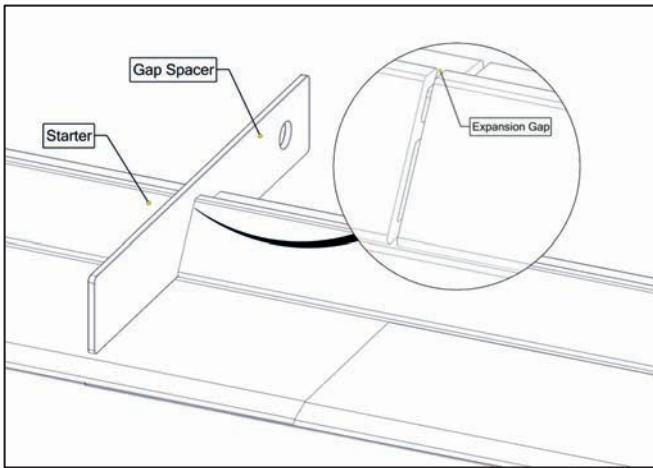
**IMPORTANT**

**Starters** must be straight across the roof to properly install **PV Shingles** as well as to ensure proper appearance. After installing them, check the appearance against eaves to ensure that the array will be properly positioned.

Install the remaining **Starters** across the roof following bottom edge of the **PVLayout**.



the



Leave a gap between **Starters** using the provided **Gap Spacer**.

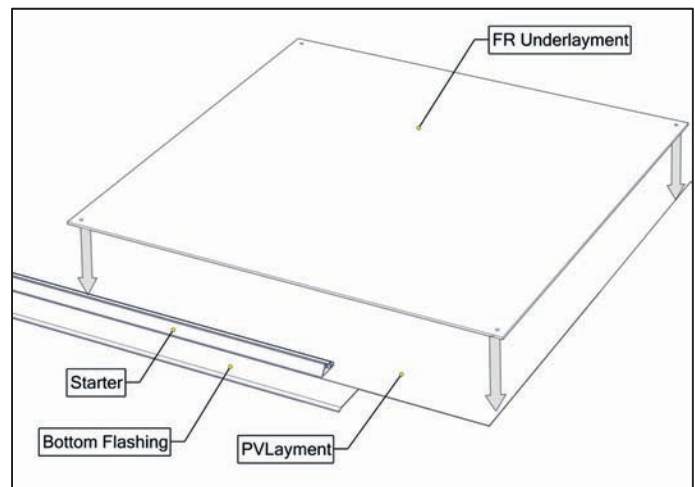


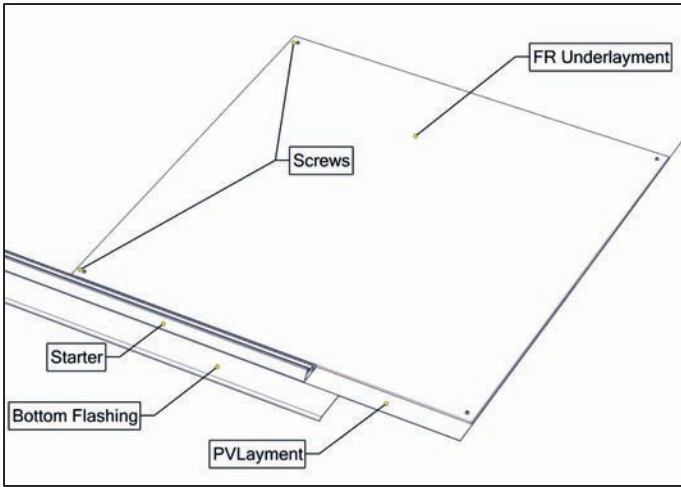
**IMPORTANT**

This gap is necessary to allow for **Starter** expansion. Ensure that the **Gap Spacer** is not bent or deformed.

**STEP 5 - Apply FR Underlayment (for Class A systems only)**

Install the **FR Underlayment** along the top edge of the **Starter** and flush with the right side of the *Underlayment Area*.

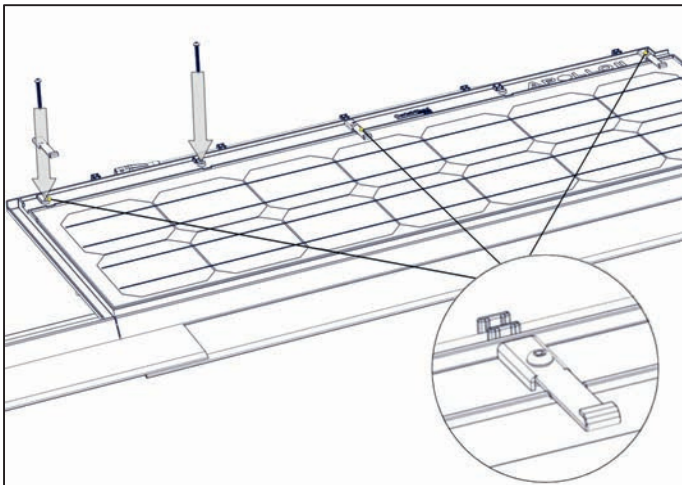
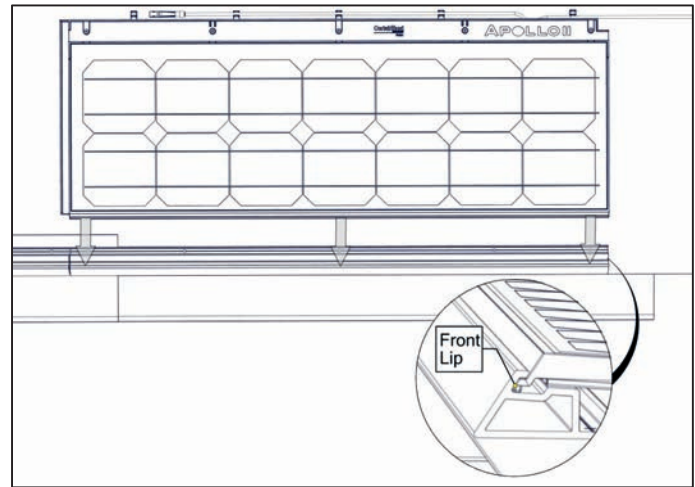




Fasten the **FR Underlayment** to the roof deck using four (4) screws, one in each corner, covering the remaining *Underlayment Area*.

## STEP 6 - Attach the Apollo II™ PV Shingle

Slide the **PV Shingle** down until the *front lip* locks onto the **Starter Strip** and is flush with either side.



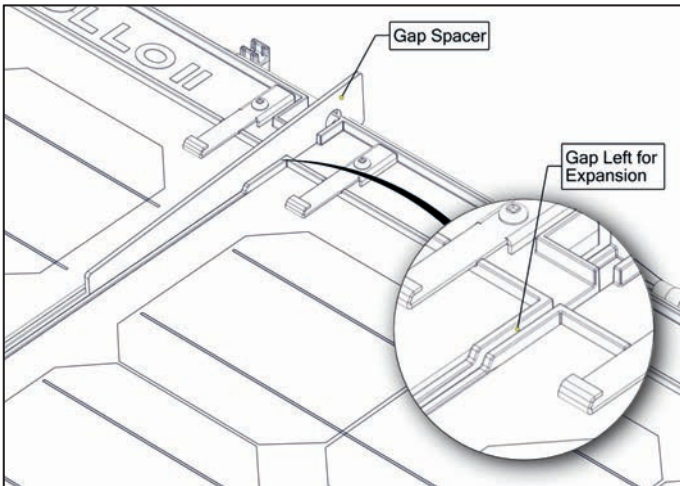
Place three (3) **Wind Clips** on the top of the **PV Shingle** in the locations indicated. Fasten the **PV Shingle** using five (5) screws.



### **IMPORTANT**

Do not over-tighten screws as this could damage the frame or strip the wood decking.

## STEP 7 – Complete the First Row



Using the same method outlined in **STEP 6** above, install the remaining **PV Shingles** in the first row using the **Gap Spacer** to properly space the **PV Shingles**.



### **IMPORTANT**

This gap is necessary to allow for module frame expansion. Ensure that the **Gap Spacer** is not bent or deformed.

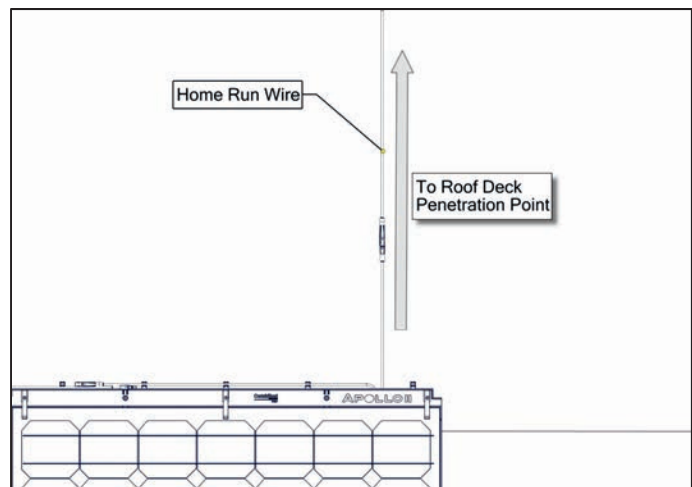
## STEP 8 – Wiring the PV Shingles

### **WARNING**



Apollo II™ PV Shingles generate DC electricity when exposed to any light source, whether or not they are connected in a circuit. Always treat the output wires as a potential shock hazard. The shock hazard increases when PV Shingles are connected in series. **DO NOT** connect panel wiring under wet conditions. Review the **Safety Precautions, Proper Connections** and **Proper Wire Management** sections before making any electrical connections. A qualified person must be present when wiring is being done during the installation of the array. Check with your local AHJ for local requirements.

Connect a **Homerun Wire** to the first **PV Shingle** in the series string. This **Homerun Wire** will run to the *roof deck penetration point* at the top of the array where the wiring enters the building.



### **NOTE**



**Homerun Wires** are supplied with a positive connector on one end and a negative connector on the other end. **Homerun Wire** lengths should be determined and the **Homerun Wire** cut to make two lengths; one with a positive connector and one with a negative connector.



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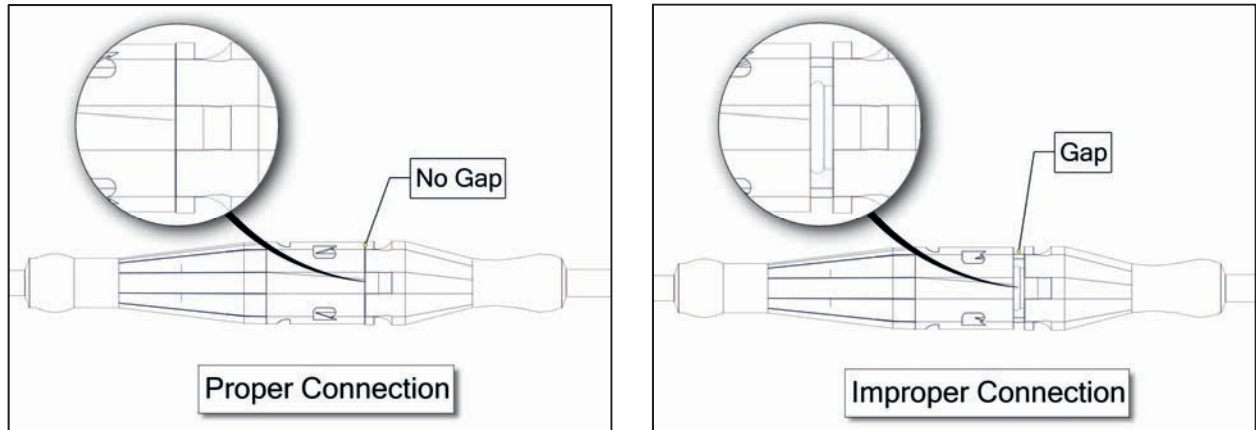
**IMPORTANT**

Be sure you have reviewed and fully understand the **Stringing Diagram** before attempting any wiring. An example is located in **Appendix A**.

---

**Proper Connections**

Wiring Apollo II™ PV Shingles together into strings is simple using the provided male-female, positive and negative connectors. Simply plug the connectors together until they lock which will ensure that they are fully mated as shown below. Once connected, gently attempt to pull the connectors apart to verify that they are fully mated and locked.

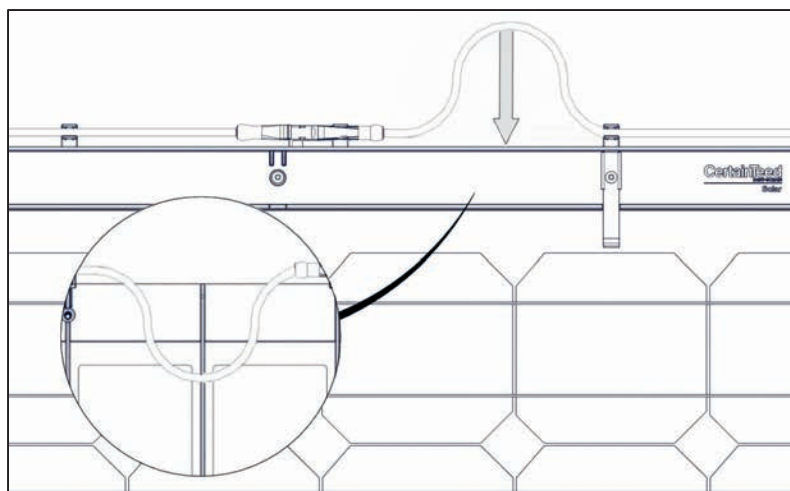
**Wire Management**

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**CAUTION**

As you connect the PV Shingles together in the row, it is critical any additional wire length and the connectors be managed. Excess wire length can be stored below the **PV Shingle**.

---



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**IMPORTANT**

The accumulated string voltage should be checked after the installation of each row to ensure that all connections have been made properly and all **PV Shingles** are functioning. See **Appendix B** for instructions on checking voltage.

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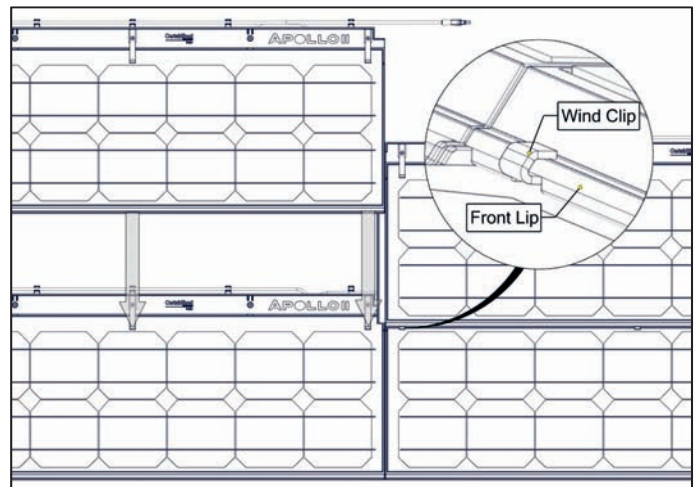
## STEP 9 - Installing the Next Row of PV Shingles

### **WARNING**

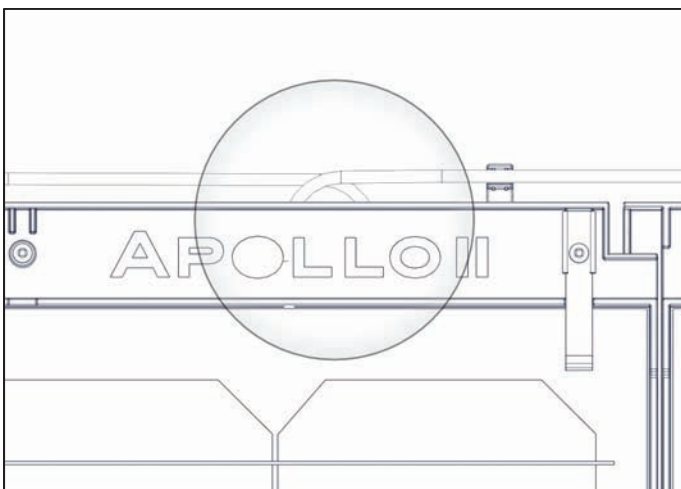


It is critical to make sure that no wires are pinched between the **PV Shingle** frame and the deck. Ensure that all wiring from previously installed **PV Shingles** is properly secured in wire management clips and excess stored under the **PV Shingles** before attempting to install the next row. **PV Shingles** should lay as flat as the existing deck allows. If they do not, it may be an indication that there is a pinched wire.

Starting from the right side, install the next row of **PV Shingles**. Slide the **PV Shingle** down until the *front lip* locks into the **Wind Clips** installed on the **PV Shingle** in the prior row.



## STEP 10 - Wiring the Second Row



When wiring the next row, the polarity of the connectors will need to be switched. To do this, simply cross the wires as they exit from the upper portion of the **PV Shingle**.

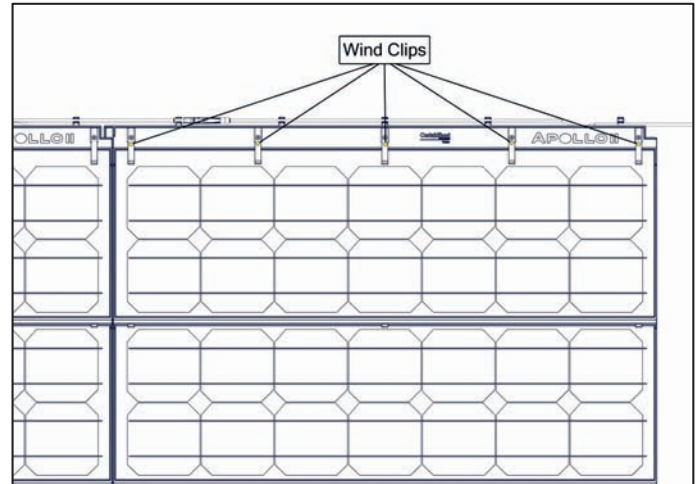
### **IMPORTANT**



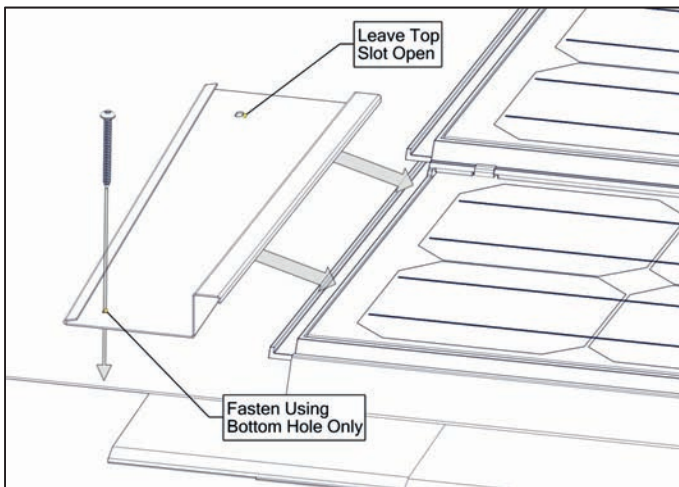
**PV Shingles** are designed to be installed in rows moving from right to left. Stringing (electrically connecting the **PV Shingles**) should be done in an “S” pattern. Every other row will require crossed wires. If the array contains multiple strings, ensure that you are aware of where one string ends and the other begins. See sample **Stringing Diagram** in **Appendix A**.

## STEP 11 – Continue Installing PV Shingles

Continue installing PV Shingles until you reach the final row. Install five (5) wind clips on each module in the final row.

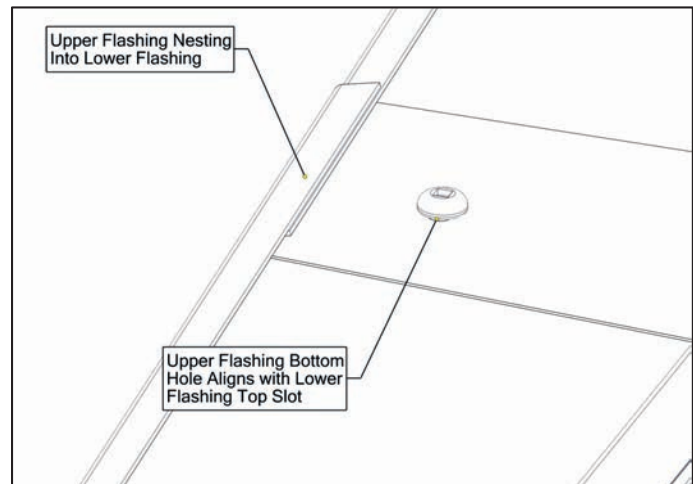


## STEP 12 – Install Side Flashing

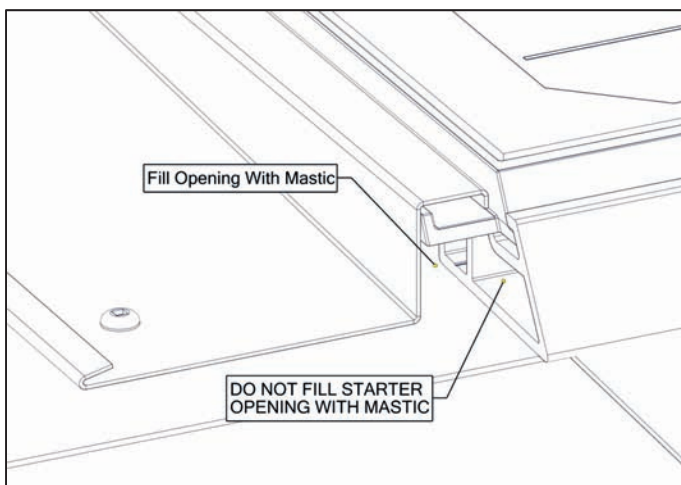


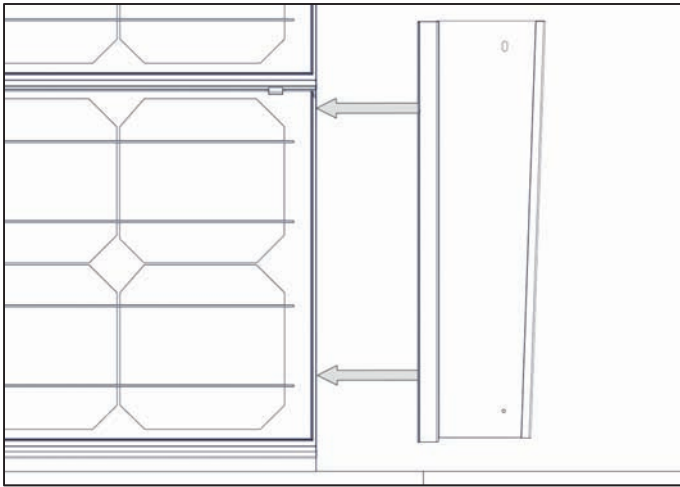
Install the **Left Side Flashing** so that it covers the edge of the **PV Shingle** to the right and slides under the edge of the **PV Shingle** above. Fasten through the bottom hole using a 1-1/4" fully threaded screw.

As additional **Left Side Flashings** are installed, be sure that the upper flashing nests into the hem of the lower flashing. Align the slot at the top of the lower flashing and the hole in the bottom of the upper flashing. Fasten using 1-1/4" fully threaded screws.



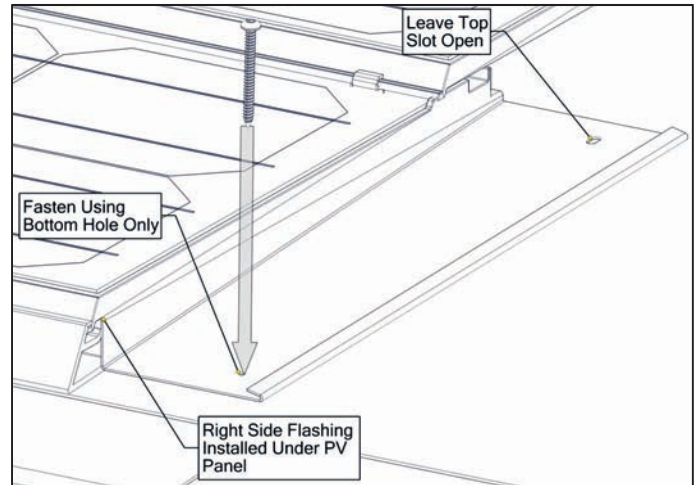
Install one **Left Side Flashing** for each row of **PV Shingles**.





Slide the **Right Side Flashing** under the edge of the **PV Shingle**.

Fasten the **Right Side Flashing** through the bottom hole using a 1-1/4" fully threaded screw. When installing additional **Right Side Flashings** be sure that the upper flashing nests into the hem of the lower flashing. Align the slot at the top of the lower flashing and the hole in the bottom of the upper flashing. Fasten using 1-1/4" fully threaded screws.



**IMPORTANT**



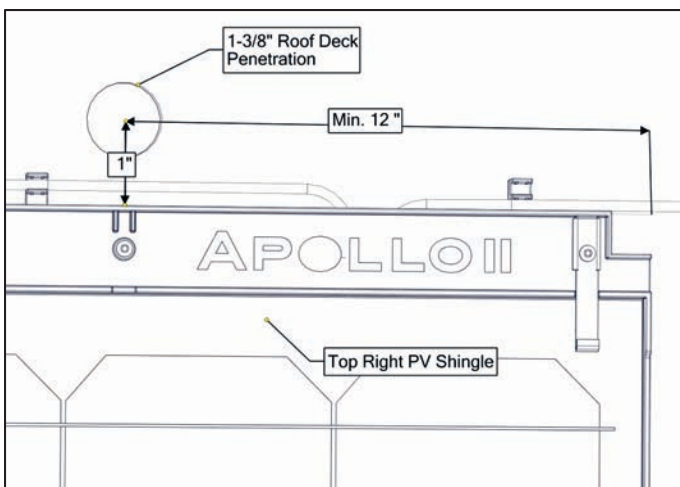
**Side Flashing** is not designed to be interwoven with asphalt shingles. **DO NOT** nail the flashing. Use only the recommended screws to fasten the flashing.

**STEP 13 - Roof Deck Penetration**

**IMPORTANT**

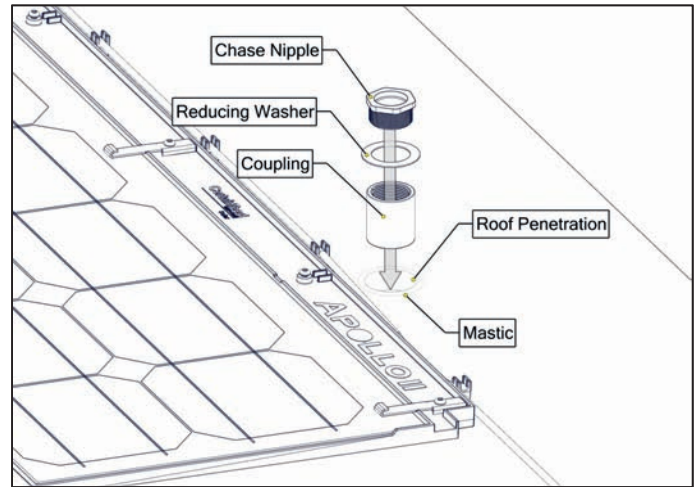


For wiring intended to run across the roof surface, skip **STEP 13** and see **Off-Roof Wiring**.

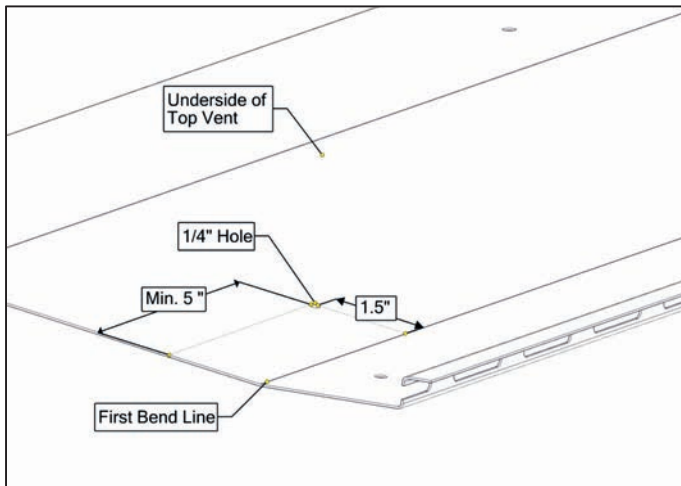


Ensure that the *roof deck penetration point* is clear of any rafters. Using a hole saw or spade bit, drill a 1-<sup>3</sup>/<sub>8</sub>" hole through the roof deck centered 1" from the top edge of the **PV Shingle**. Do not locate the hole closer than 12" from the left or right corners.

Assemble the **Chase Nipple**, **Reducing Washer** and **Coupling** into the **Penetration Bushing**. Apply mastic around the **Penetration Bushing** and press into the hole.

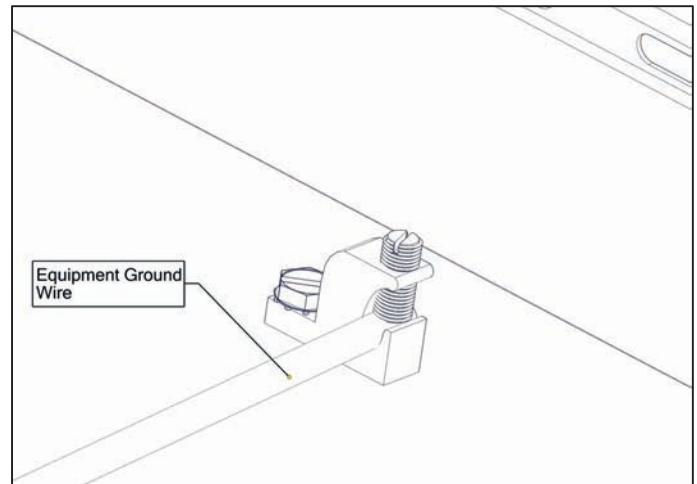


### STEP 14- Install Equipment Ground



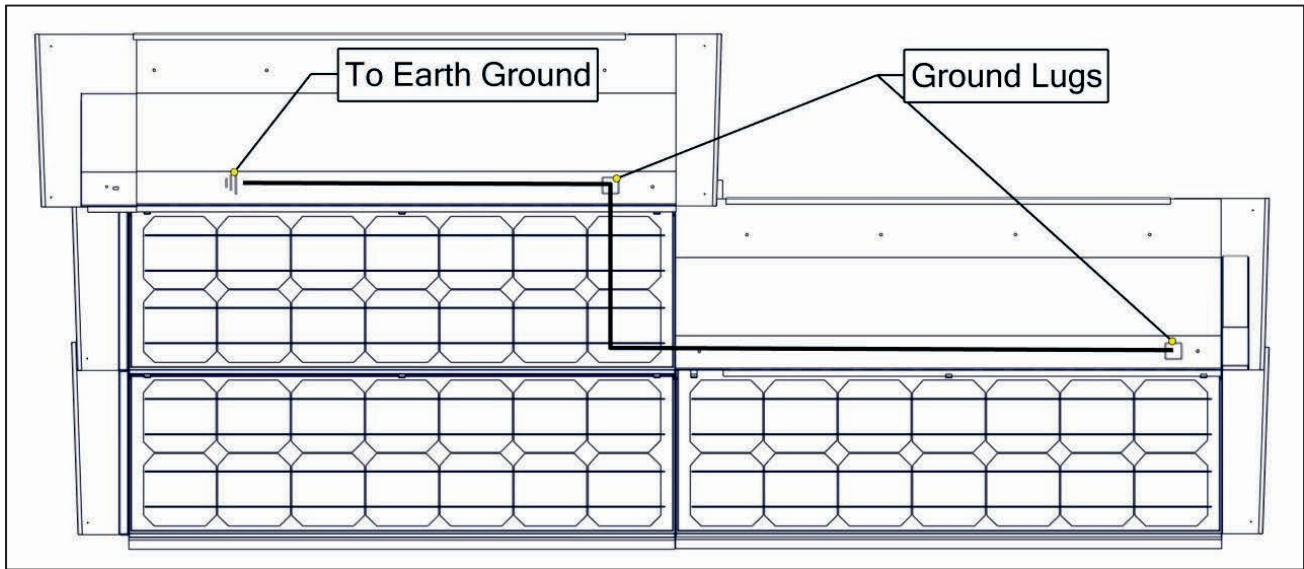
Position a **Top Vent** upside down and drill a  $\frac{1}{4}$  " hole a minimum of 5" from either edge and 1- $\frac{1}{2}$  " from the *first bend line* as shown below. Secure the **Ground Lug** using the supplied bolt and **Bonding Locknut**. Torque to 25 in-lbs.

Install the equipment ground wire. Run all **Homerun Wires** as well as the equipment ground wire through the *roof deck penetration point* to an interior termination point.



#### **IMPORTANT**

When there are multiple rows of **Top Vents**, each row must be grounded as shown above and bonded together with a continuous ground wire.



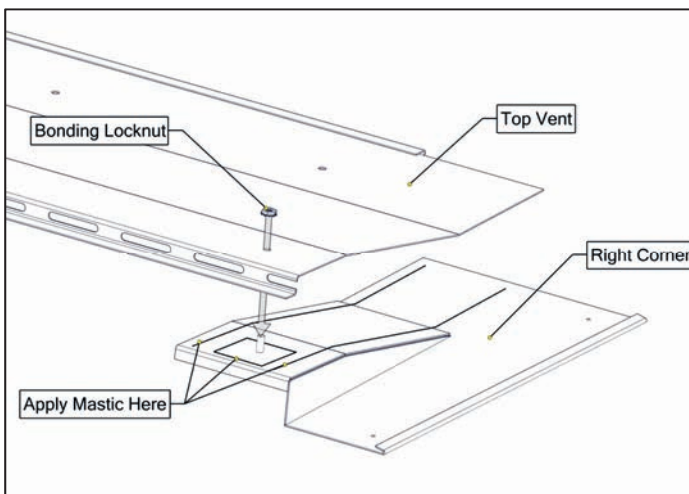
**WARNING**



The cut ends of the **Homerun Wires** are **LIVE**. **DO NOT** allow them to come into contact with each other. Each one must be capped with a wire nut and electrical tape before placing them through the *roof deck penetration*.

**STEP 15 - Install the Right Corner and First Top Vent**

**Top Vents** are designed to be installed from right to left starting at the upper right corner of the array. Joints between **Top Vents** and corner flashings are to be sealed using mastic as shown.



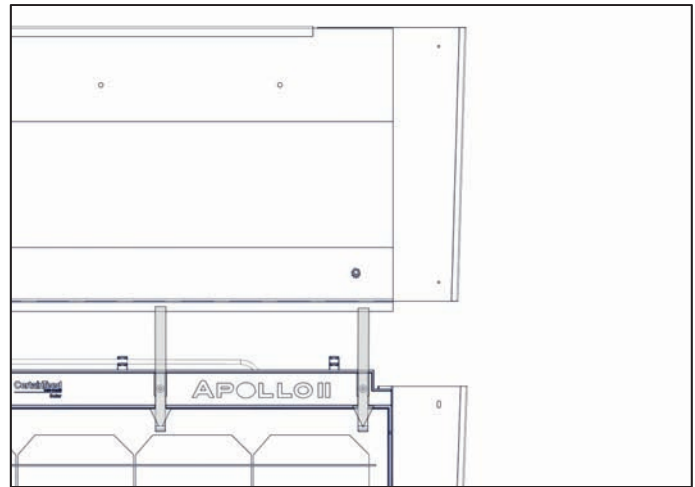
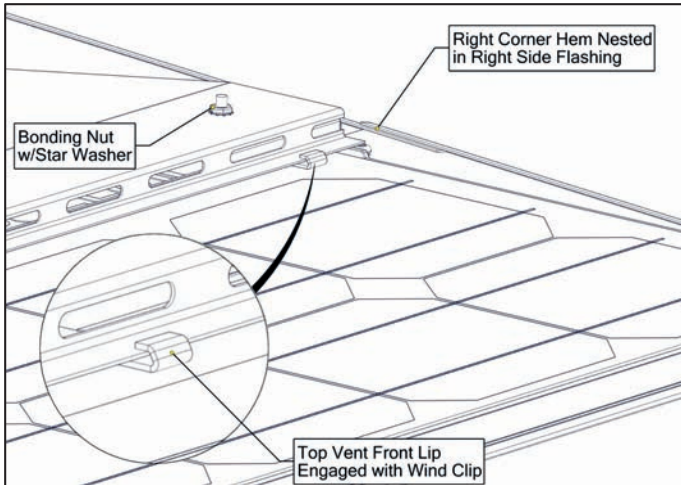
Attach a **Right Corner** to a **Top Vent** using a **Bonding Locknut**.

**NOTE**



For wiring running over the surface of the roof, a **Right Corner Conduit** flashing piece may be substituted for the **Right Corner Flashing**. See *Off-Roof Wiring*.

Slide the **Top Vent** and **Right Corner** down until the **Top Vent front lip** is fully engaged with the **Wind Clips**.



Ensure that the **Right Corner** hem is nested into the **Right Side Flashing**.

#### **IMPORTANT**



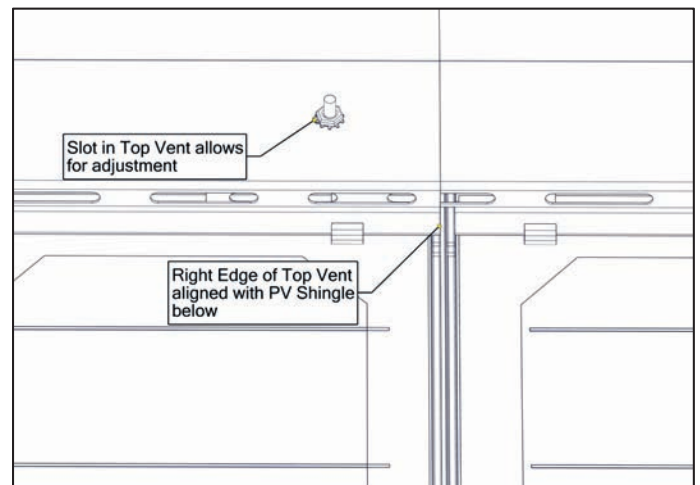
Ensure all **Wind Clips** have engaged the *front lip* of the **Top Vent**. **DO NOT** fasten **Top Vents** until all are properly positioned.

#### **BONDING REQUIREMENT**



The **Bonding Locknut** is intended to bond the **Right Corner Flashing** and the **Top Vent** as well as subsequent **Top Vents** and **Corner Flashing** pieces. Hand-tighten **Bonding Locknuts** until all **Top Vents** have been positioned. Once all **Top Vents** have been positioned, **Bonding Locknuts** must be torqued to 25 in-lbs.

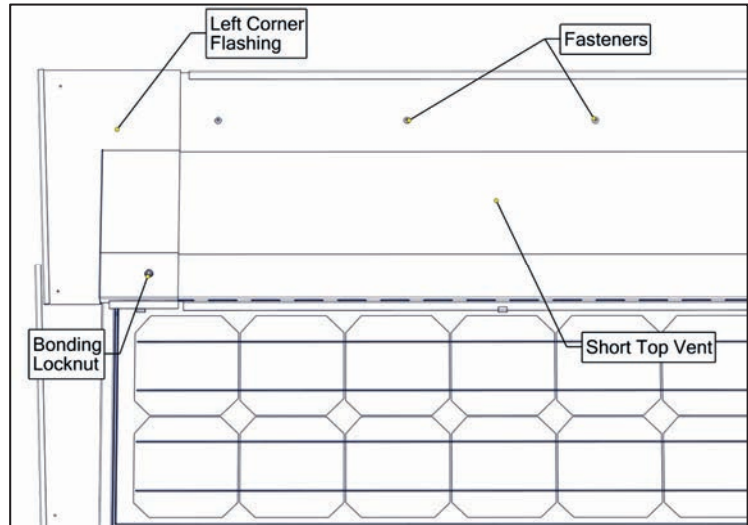
Continue installing **Top Vents** moving right to left. Align the right side of each **Top Vent** with the right side of the **PV Shingle** below it.



Substitute a **Short Top Vent** for a **Top Vent** in the last position in a row or if only one top vent is needed in the row. Once all **Top Vents** and **Short Top Vents** are properly positioned, fasten using recommended screws.

## STEP 16 - Install the Left Corner

Once all **Top Vents** are installed, install the **Left Corner** over the **Short Top Vent**. Secure the **Left Corner** with fasteners.



### NOTE



For wiring running over the surface of the roof, an **Off-Roof Corner** flashing piece may be substituted. See **Off-Roof Wiring**.

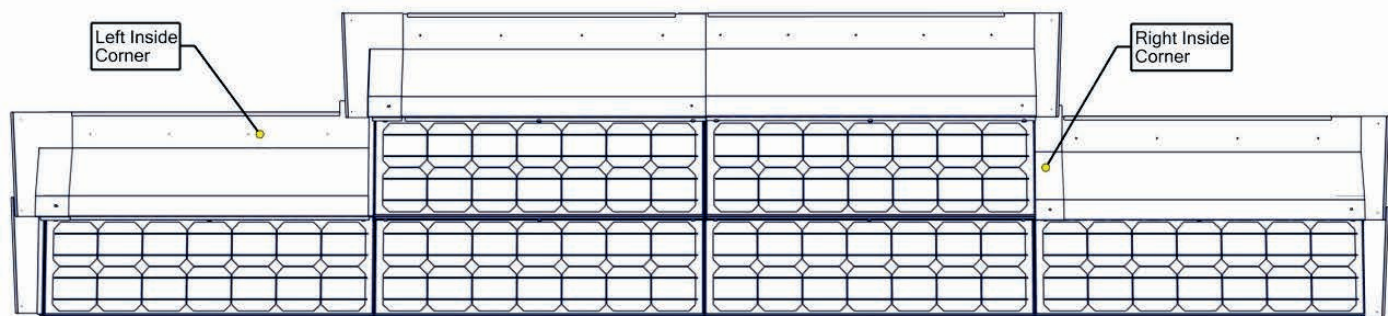
### BONDING REQUIREMENT



Ensure that all **Top Vents** and **Corners** are bonded together using a **Bonding Locknut**. **Bonding Locknuts** must be torqued to 25 in-lbs.

## Non-standard Installation Instructions

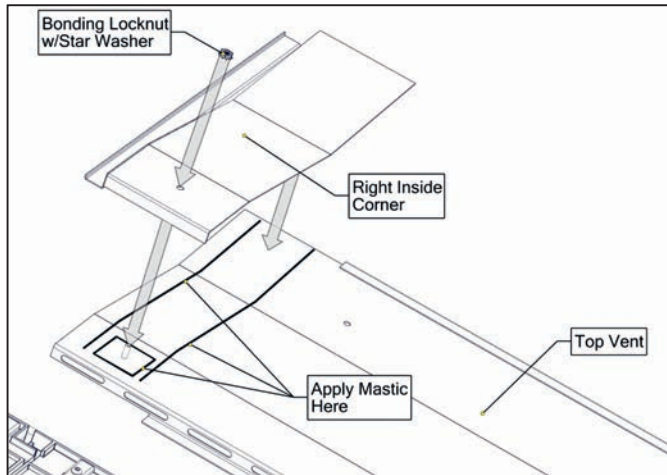
### Installing Non-rectangular Arrays



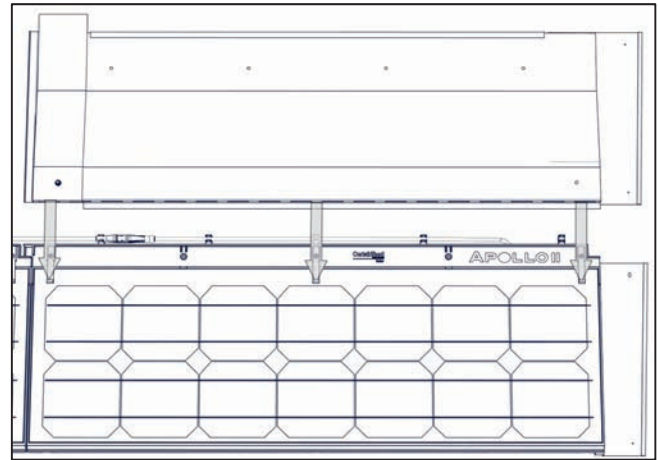
A **Left** or **Right Inside Corner** flashing piece is used to flash the inside corners.



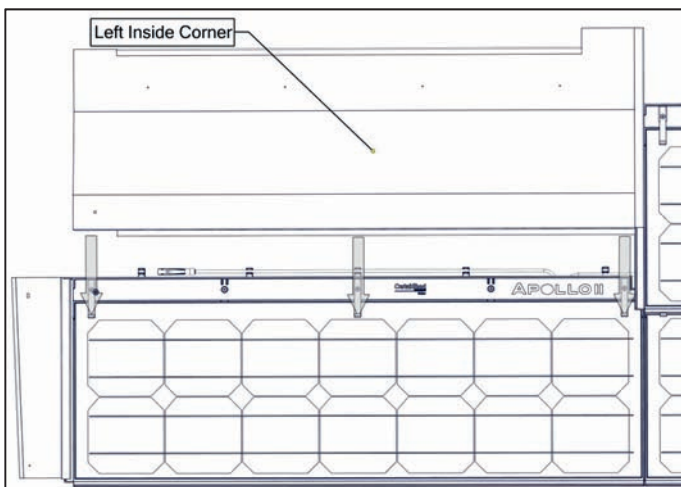
## Right Inside Corner Installation



Apply mastic to the **Top Vent** as shown then attach the **Right Inside Corner** to the **Top Vent** using a **Bonding Locknut**.



Install assembly, ensuring proper engagement of **Top Vent** to **Wind Clips**.

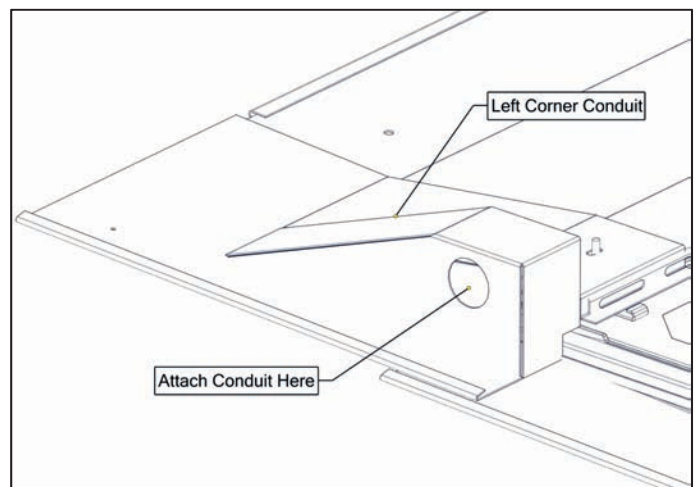


## Left Inside Corner Installation

Install **Left Inside Corner** by sliding it down until it is engaged with the **Wind Clips**. Fasten with recommended screws.

## Off-Roof Wiring

**Left** and **Right Corner Conduit Flashing** pieces can be substituted for **Left** and **Right Corner Flashing** pieces in the event that wiring will be run across the roof surface.



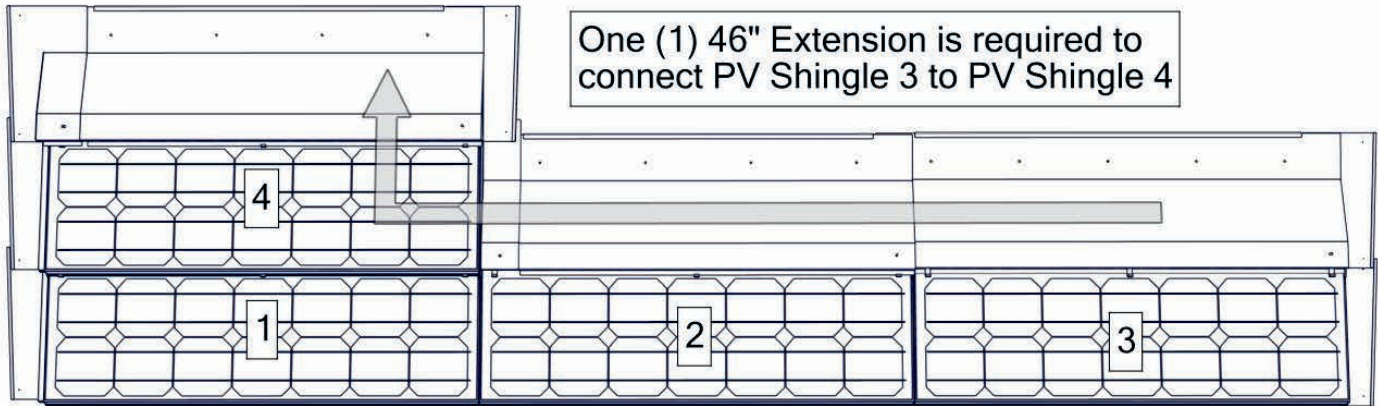
## Wiring Inside Corners

For each inset greater than one panel, an **Extension** is necessary to complete the wiring. For example, a two panel inset (shown below) requires one **Extension**, a three panel inset would require two **Extensions**, and so on.

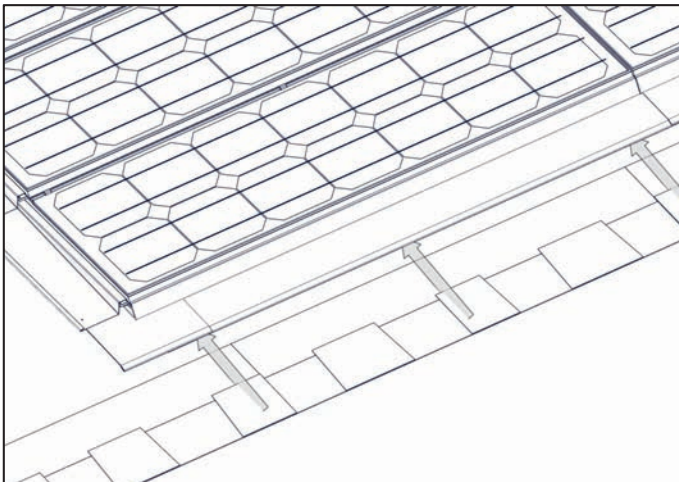
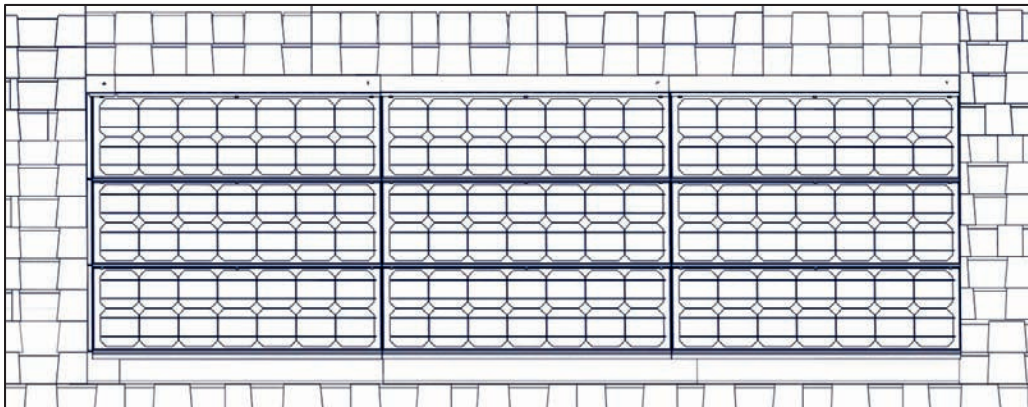


### NOTE

Follow wire management practices outlined in the **STEP 8 – Wiring the PV Shingles**.

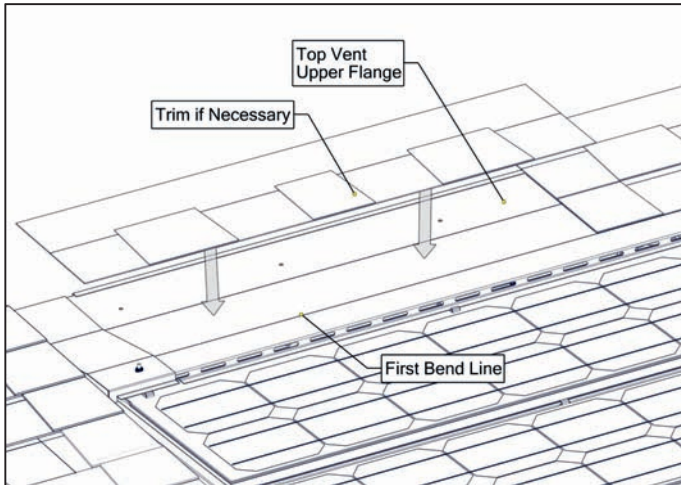
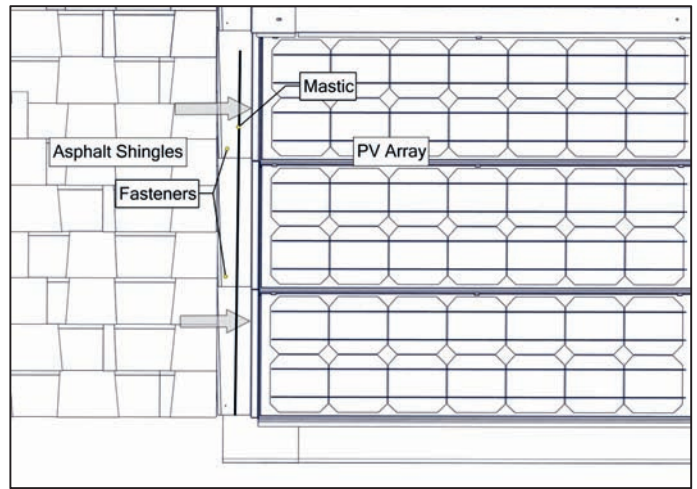


## Install Surrounding Asphalt Shingles



Trim the last course of asphalt shingles to fit under the **Bottom Flashing**. This course should be installed using the same methods when approaching a side wall flashing on a typical shingle roof installation.

Apply mastic to the flange of each **Side Flashing** piece and each **Corner Flashing** piece before installing surrounding asphalt shingles.



Hand seal the first row of shingles to the **Top Vent**. Alternatively use a product such as CertainTeed Swift Start™ under the first row of asphalt shingles on the **Top Vent**.

---

#### **WARNING**



When applying asphalt shingles, **DO NOT** nail through the raised portion of the **Top Vent**. Nails may only be placed through the *upper flange* which rests flush against the deck (see above illustration).

---

Continue installing asphalt shingles above the **Top Vent** following the shingle manufacturer's application instructions.

### **Completing the Apollo II™ System**

Once the Apollo II™ system is installed, apply **Safety Labels**, per the NEC and any applicable local codes. Ensure that **Safety Labels** are applied to a clean, dry surface.

### **Balance of System Installation**

Balance of system (BOS) components supplied with the Apollo II™ system include an inverter and **Homerun Wires**. Refer to the inverter manufacturer's installation instructions for proper inverter installation. All other BOS components will need to be supplied by the installer. These include, but are not limited to, wiring, conduit, conduit fittings, disconnects, overcurrent protection devices and specialty labels.



#### **IMPORTANT**

For field wiring, use minimum 14AWG wire rated for minimum 90°C.

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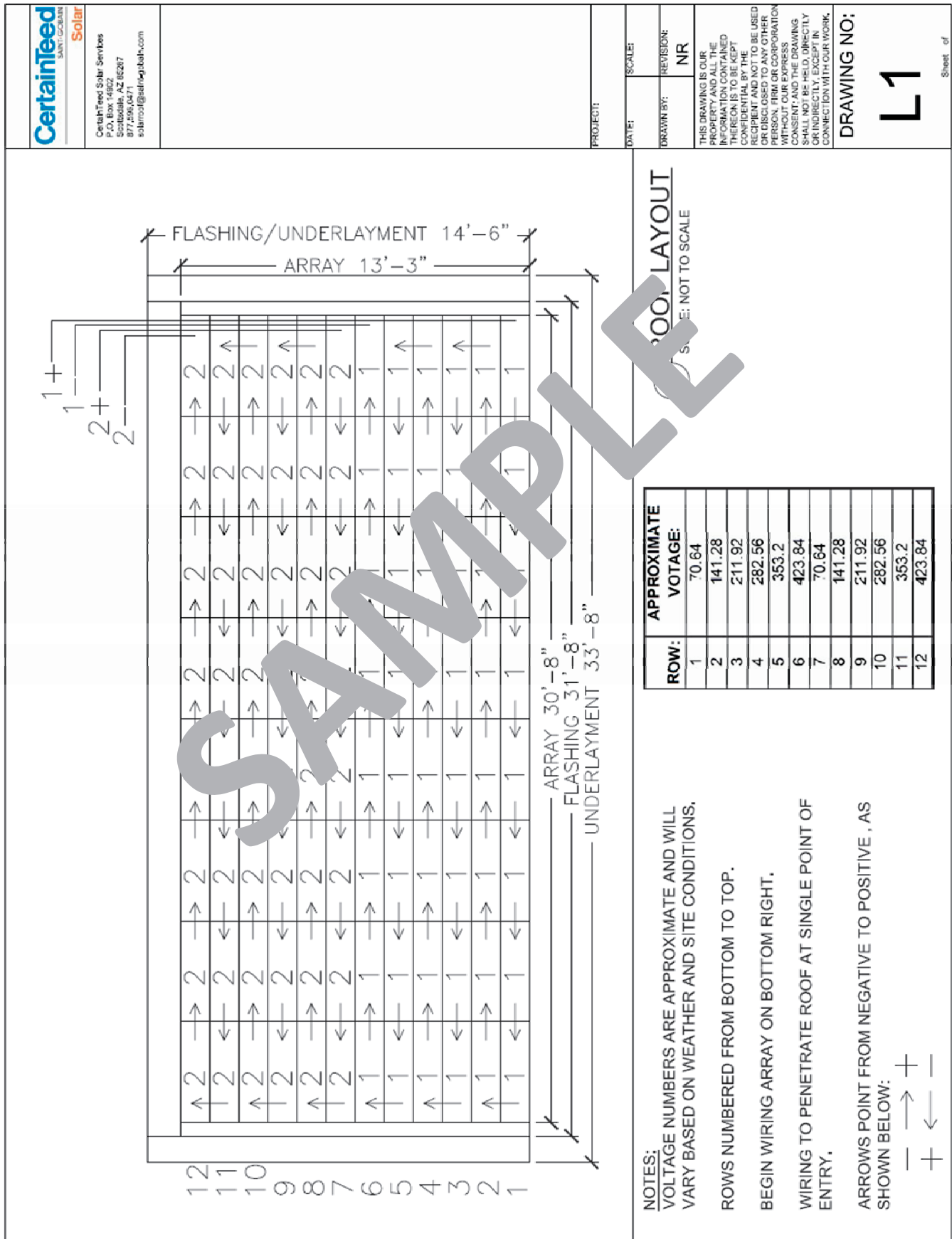


#### **IMPORTANT**

Selection and installation of these components must conform to the National Electrical Code (NEC) if in the US, Canadian Electrical Code Part I (CSA C22.1) if in Canada, and any applicable local codes.

---

# Appendix A



**CertainTeed**  
SUNY CORPORA  
Solar

CertainTeed Solar Services  
P.O. Box 14902  
Scottsdale, AZ 85267  
877.266.0471  
solarinfo@certainteed.com

PROJECT:

DATE: SCALE:

DRAWN BY: REVISION: NR

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DRAWING NO:  
**L1**

Sheet of

**ROOM LAYOUT**  
SCALE: NOT TO SCALE

| ROW: | APPROXIMATE VOLTAGE: |
|------|----------------------|
| 1    | 70.64                |
| 2    | 141.28               |
| 3    | 211.92               |
| 4    | 282.56               |
| 5    | 353.2                |
| 6    | 423.84               |
| 7    | 70.64                |
| 8    | 141.28               |
| 9    | 211.92               |
| 10   | 282.56               |
| 11   | 353.2                |
| 12   | 423.84               |

**NOTES:**  
VOLTAGE NUMBERS ARE APPROXIMATE AND WILL VARY BASED ON WEATHER AND SITE CONDITIONS.

ROWS NUMBERED FROM BOTTOM TO TOP.

BEGIN WIRING ARRAY ON BOTTOM RIGHT.

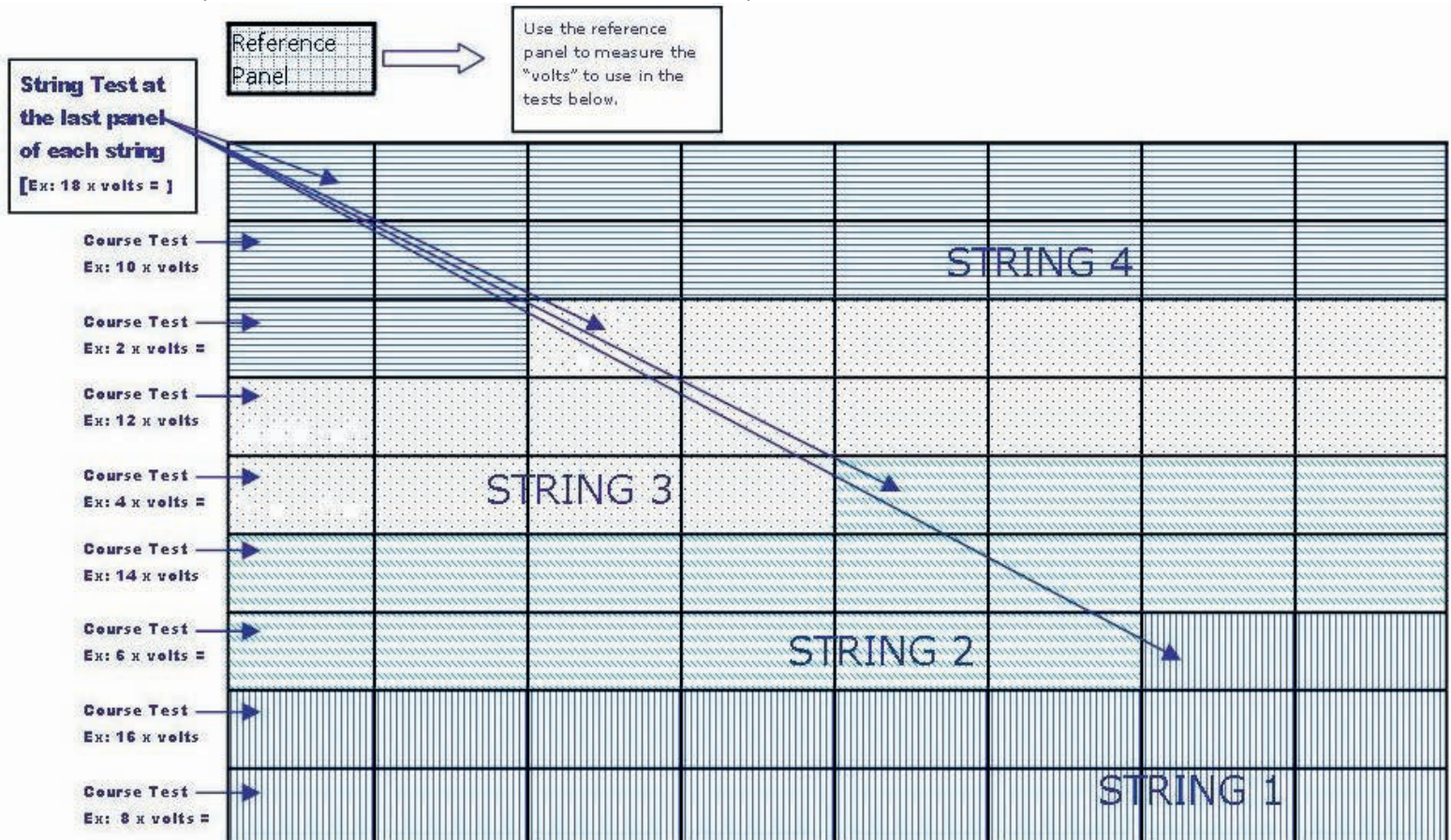
WIRING TO PENETRATE ROOF AT SINGLE POINT OF ENTRY.

ARROWS POINT FROM NEGATIVE TO POSITIVE, AS SHOWN BELOW:

— → +  
+ ← —

## Appendix B - How to Test a Row/String During Installation

1. **Testing Voltage.** During the installation it is important that you test each row **and** each string of **PV Shingles** in order to locate any loose connections or broken **PV Shingles** and replace them without "uninstalling" **PV Shingles**.
  - a. **Reference Shingle.** Place a **PV Shingle** on the roof at point near the top of the roof at the same tilt and orientation of the solar array. When you are ready to test a row, measure the voltage output of the *Reference PV Shingle*. The voltage may vary throughout the day depending on light conditions and the temperature of the panel and should be checked each time you are testing a row or string. The normal output will be around 8-9 Volts per **PV Shingle**.
  - b. **Row Test.** To test a row, connect a multi-meter to the **Homerun Wire** from the first **PV Shingle** in the string and the open connector on the final **PV Shingle** in the row. In each subsequent row you will need to add the number of **PV Shingles** within the string in the prior row(s). If the voltage measurement is within 1 percent of the calculated total, the circuit is acceptable.
  - c. **String Test.** To test the string, connect a multi-meter to the **Homerun Wire** from the first **PV Shingle** in the string and the open connector on the final **PV Shingle** in the string. If the voltage measurement is within 1 percent of the calculated total, the circuit is acceptable.









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CertainTeed Corporation  
15825 N. 71st St. Suite 205  
Scottsdale, AZ 85254

Phone: 877-596-0471  
[solarroof@saint-gobain.com](mailto:solarroof@saint-gobain.com)

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Code No. 20-20-3423