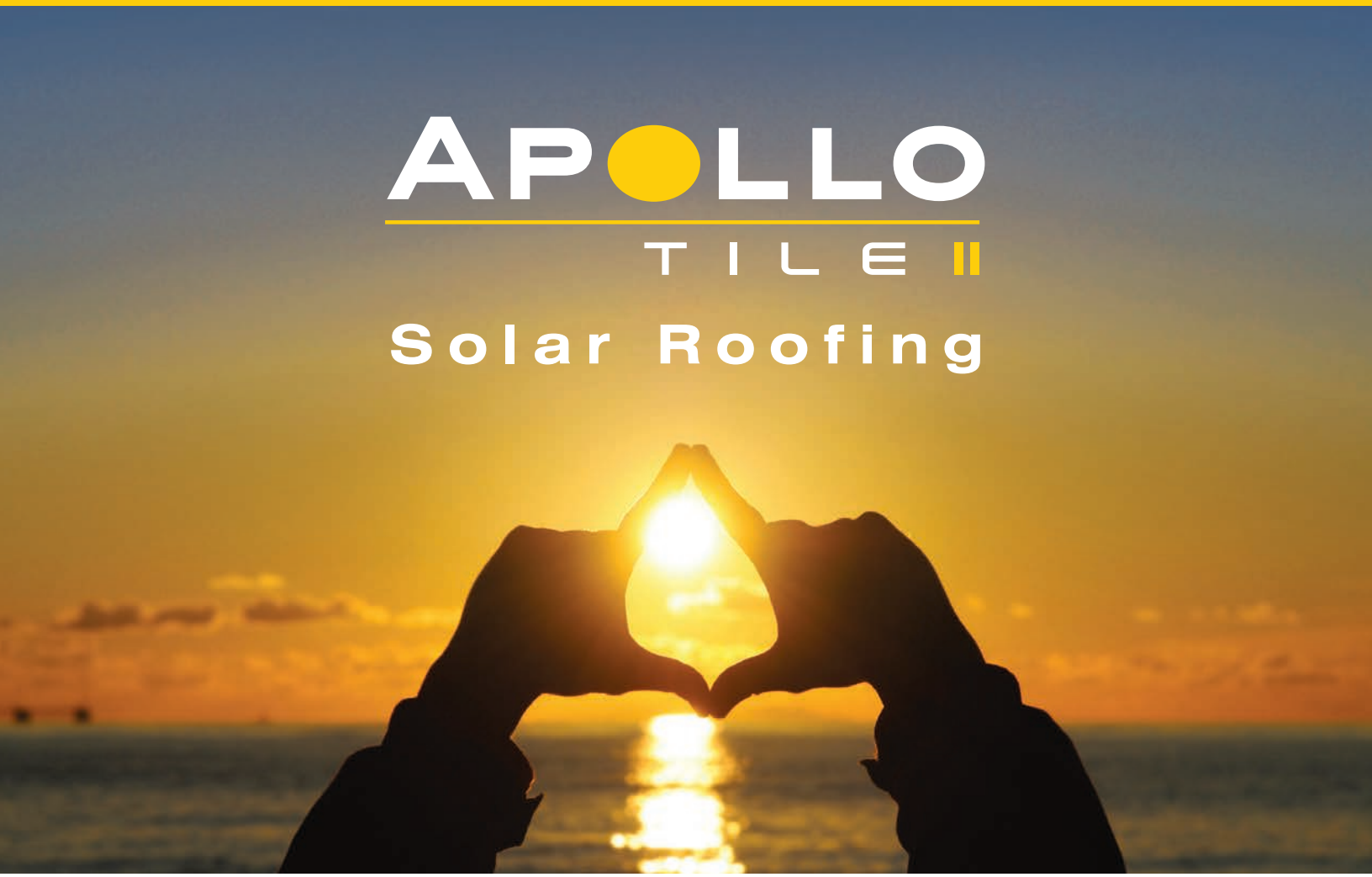


Installation Instructions

CertainTeed
SAINT-GOBAIN
Solar

Apollo Tile II™ Installation Instructions Key

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

IMPORTANT
Used to denote steps or actions critical to proper installation

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

WARNING!
Used to denote steps or actions critical to health and safety

Safety Precautions

- An Apollo Tile II™ system must be installed by a Credentialed Contractor. Potentially dangerous electrical voltage is present in Apollo Tile II™ PV Tiles and system components. The installer must be familiar with appropriate safety procedures for handling electricity and must wear appropriate Personal Protective Equipment (PPE).
- Apollo Tile II™ PV Tiles do not have an "On/Off" switch and generate electricity when exposed to any light source. The shock hazard from the PV Tiles 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 Tiles 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 the Apollo Tile II™ PV Tiles 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 Tile II™ PV Tiles connectors when the inverter is under load or operating.
- **DO NOT** redirect or concentrate sunlight or artificial light onto the Apollo Tile II™ PV Tiles.
- Apollo Tile II™ PV Tiles may be walked on when property installed. However, extreme care must be taken. The surface of the PV Tile presents a slip hazard, especially when wet. The panel surface can also be damaged by abrasion from small stones and other debris. Only trained personnel should walk on the PV Tiles. 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 PV Tile 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 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 the Apollo Tile II™ PV Tiles' 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 100 mW/cm^2, AM 1.5 spectrum, and a cell temperature of 25˚C (77˚F)).

- Apollo Tile II™ PV Tiles 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 installer 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 Tile II™ PV Tiles are designed to integrate with most flat concrete tiles. It is the contractor's responsibility to ensure that the PV Tile side channel profile and exposure will match the characteristics of the existing concrete tiles.**

- Apollo Tile II™ PV Tiles are designed to integrate with an existing tile roof. Therefore, the minimum acceptable slope for Apollo Tile II™ is that which is acceptable to the manufacturer of the concrete tile, when installed per the tile manufacturer's instructions (typically no less than 3:12).

- PV Tiles must be installed at a 13 ¼" exposure. Failure to comply with the specified exposure dimension may result in cell shading or water intrusion which may void the Apollo Tile II™ warranty.

- The roof deck and support must meet Tile Roofing Institute (TRI) Installation Guides at www.tileroofing.org or NRCA guidelines and local building code.

- PV Tiles 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 an un-interrupted solar array. **DO NOT** attempt to cut or modify the PV Tile in any way.

- PV Tiles should not be installed within 6 inches of the perimeter of the roof. The installer is responsible for consulting the 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 Tile II™ System.

Installation Requirements

- The Tile Roof Institute (TRI) has developed design and installation guidelines for roof tiles. Since Apollo Tile II™ PV Tiles are designed to be installed with flat concrete tiles, reading these documents prior to installing an Apollo Tile II™ system is highly recommended. These documents can be ordered through www.tileroofing.org.
- Only contractors trained on the installation of the Apollo Tile II™ system are permitted to install the Apollo Tile II™ system.
- Only qualified electrical contractors are permitted to install electrical components.
- Read the ***Apollo Tile II™ Installation Instructions*** and ***Inverter Installation and Operations Manual*** in their entirety before attempting to install an Apollo Tile II™ system.
- Follow all concrete tile manufacturer's instructions and standard trade practices.
- Ensure that required roofing and electrical permit(s) and inspections have been obtained from the local AHJ. 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 Tile II™ system must be performed in compliance with all applicable building, electrical and safety codes, both local and national which include, but are not limited to, the National Electric Code in the US, Canadian Electrical Code in Canada (CSA 22.1), 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

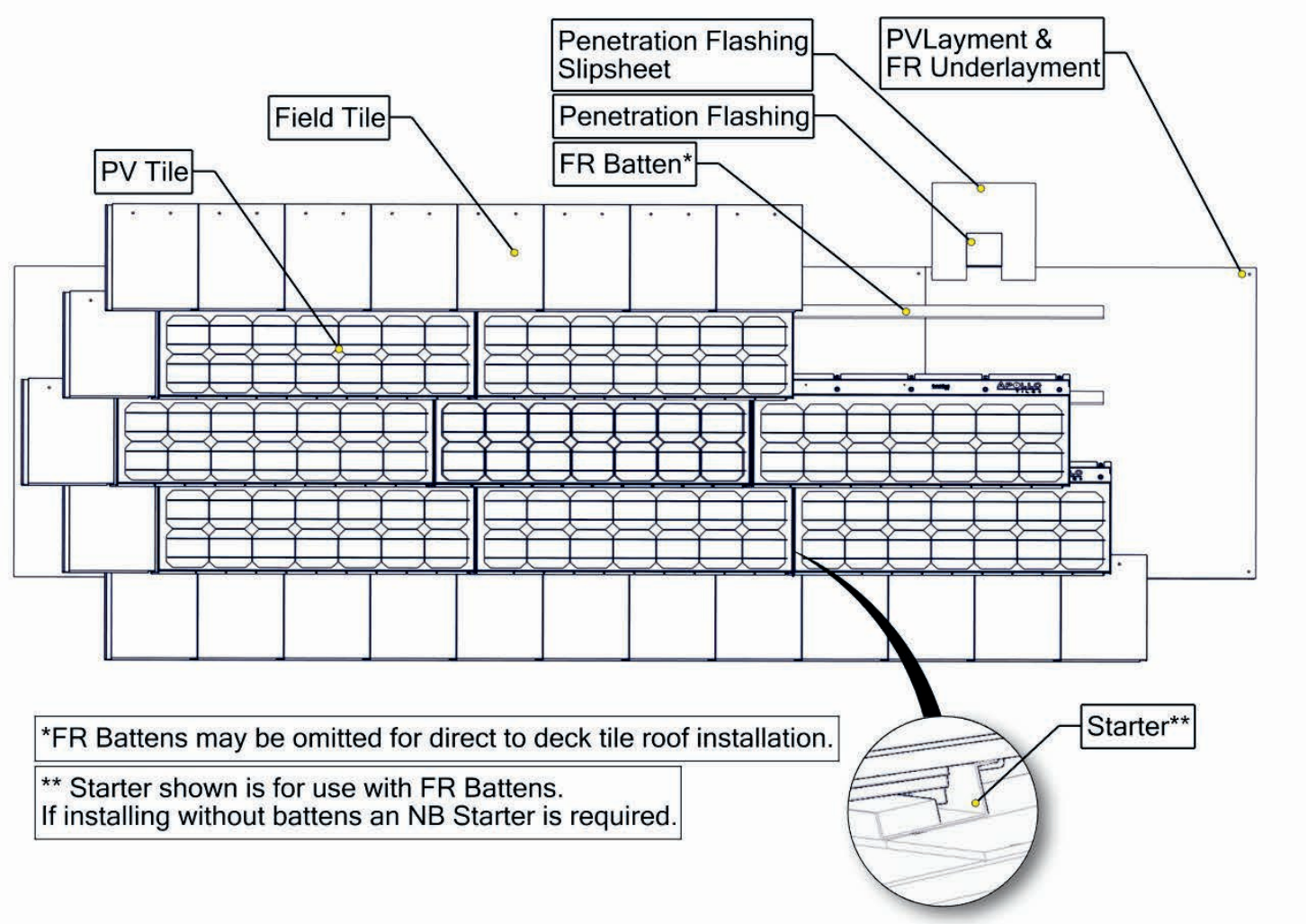
The following tools are needed to properly install the Apollo Tile II™ system:

- Tape measure
- Chalk line
- Utility knife
- Digital multi-meter
- Cordless drill
- 1-3/8" diameter hole saw/spade bit (roof deck penetration)

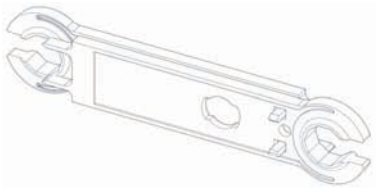
The following materials must be provided by the installer. This list is representative only, and additional materials may be required depending on the specifics of the installation and compliance with applicable building codes.

- Minimum #8 x 2-1/2" corrosion resistant screws [corrosion resistance equivalent to ASTM A641, Class A]
- Snow guards where required
- Wiring, conduit, conduit fittings, enclosures, disconnects and/or overcurrent protection devices from roof penetration to electrical service panel

System Overview



Additional Parts (not shown in System Overview)

NB Starter	
Gap Spacer	
Penetration Bushing -Chase nipple -Reducing Washer -Coupling	
PV Connector Key	
Safety Labels	
Extension (~46” length) Homerun Wires (misc. lengths)	

Prior to Installing an Apollo Tile II™ System

1. Read the Apollo Tile II™ Installation Manual in its entirety.

2. Ensure that all materials are onsite.

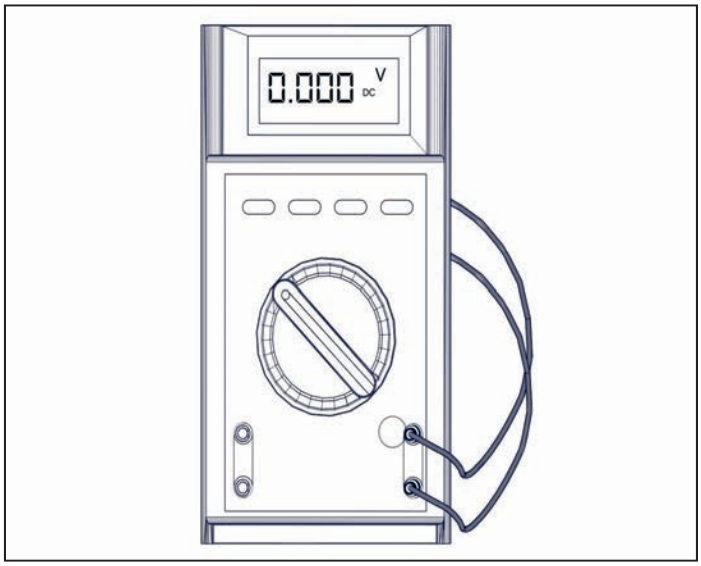
3. **The roofing contractor is responsible for laying out the array such that it fits the roof**. If obstructions are present, these should be moved and all penetrations and openings properly sealed before installing the array.

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**.

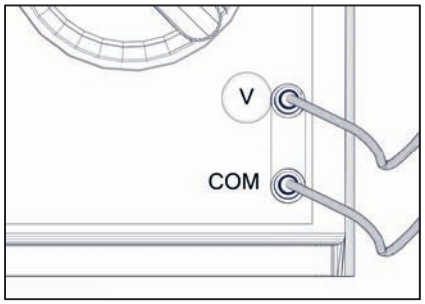
> **WARNING**
> Deviating from your electrician's ***Stringing Diagram*** will void the warranty and may result in property damage or bodily injury.

5. Based on the ***System Layout***, determine where the system will be located. Snap chalk lines as necessary to mark the appropriate areas.

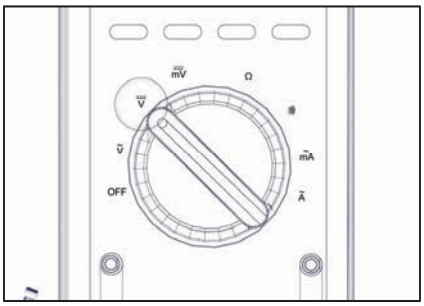
6. Verify that each Apollo II™ PV Shingle voltage (V) approximates the *Open Circuit Voltage (Voc)* specified in the **Technical Data Sheet**. Because voltage decreases with decreased availability of light, it is best to perform this test in full sunlight. Other conditions in the field may cause the voltage to vary. Generally if the measured voltage is within 10% of the specified voltage, the PV Shingle is acceptable.



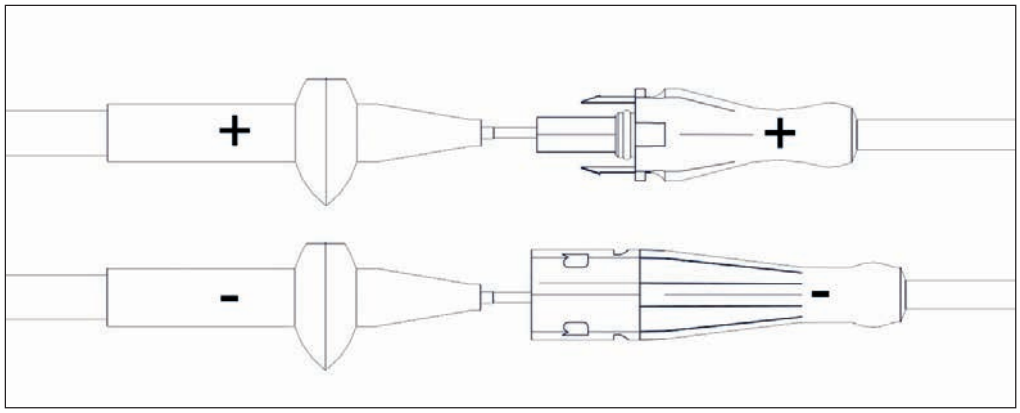
Set up Multi-Meter



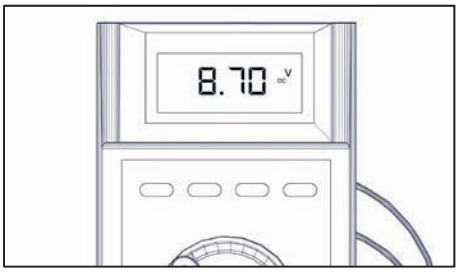
1. Insert leads into correct ports



2. Set dial to DC Volts



Insert probes into Apollo II™ connectors



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

Apollo Tile II™ Fire Rating

The Apollo Tile II™ PV system has a Class C Fire Rating when installed over one layer of **PVLayment.**

The Apollo Tile II™ PV system has a Class A Fire Rating when installed over one layer of **CertainTeed PVLayment** followed by one layer of **Fire Resistant (FR) Underlayment**.

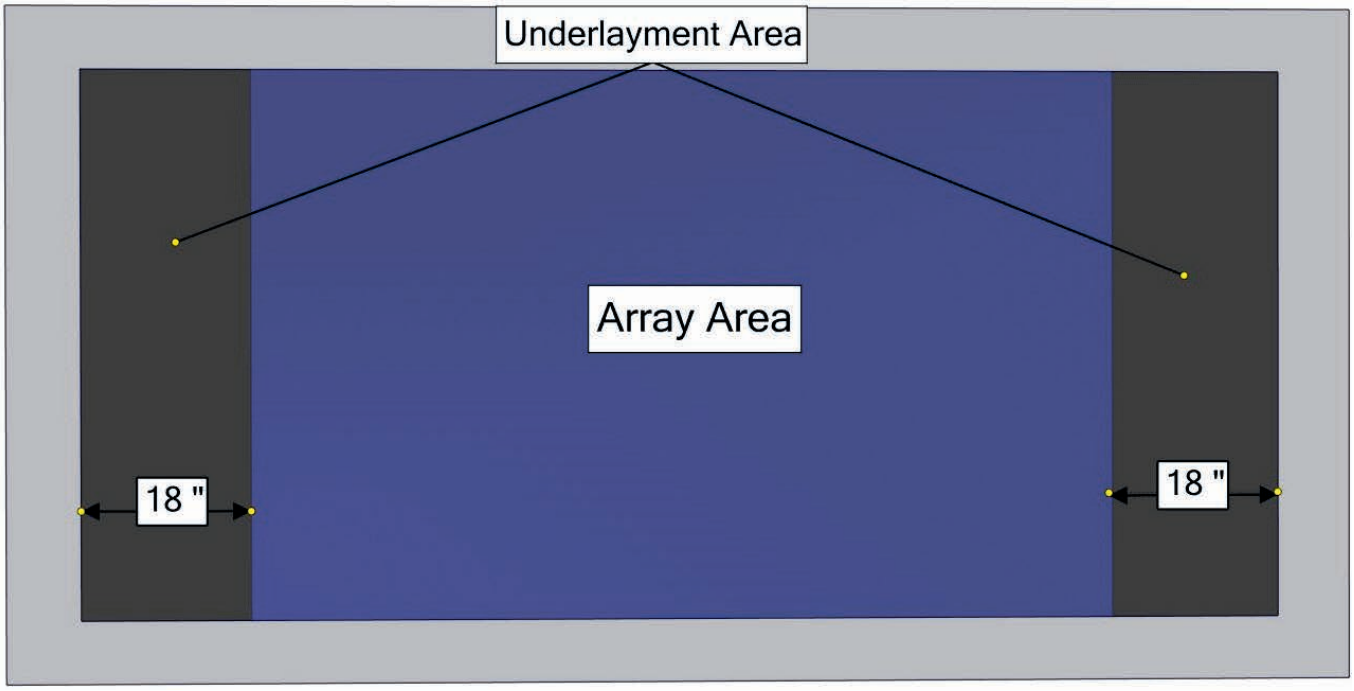
IMPORTANT

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.

Installing the Apollo Tile II™ System

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

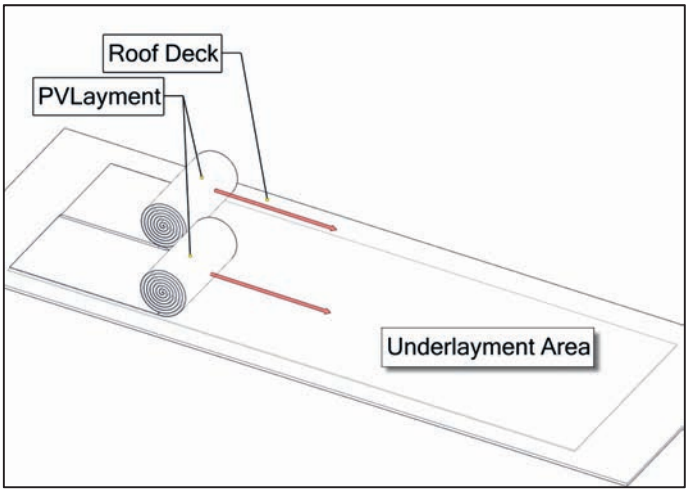
For a retrofit application, remove all tiles, battens, nails and any other materials within the PV Tile *Array Area*. Remove concrete tiles and battens one course below the *Array Area* (in order to install the **Starter**), and a minimum of 18" to the left and right of the *Array Area* until a clean, smooth, dry roof deck is reached. Replace deck materials if necessary to ensure the roof deck is flat.

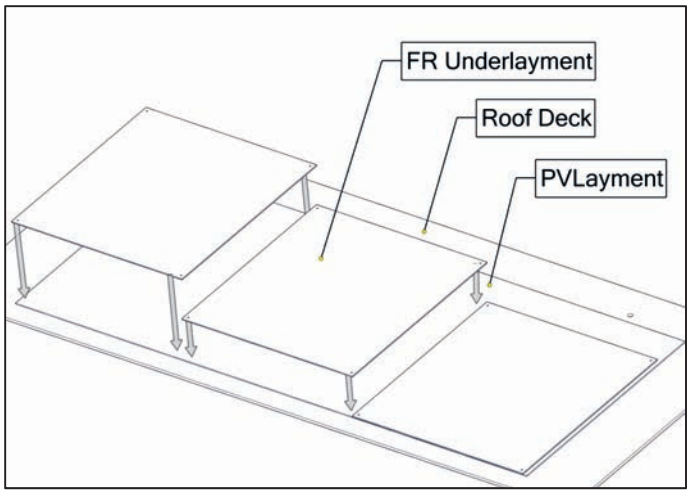


STEP 1 - Apply Underlayments

IMPORTANT
Ensure that the roof deck is clean, smooth, dry and free of any debris.

Apply a single layer of **CertainTeed PVLayment**. Fill the *Underlayment Area* vertically and horizontally using a 6" overlap on vertical seams and a 3" overlap on horizontal seams.

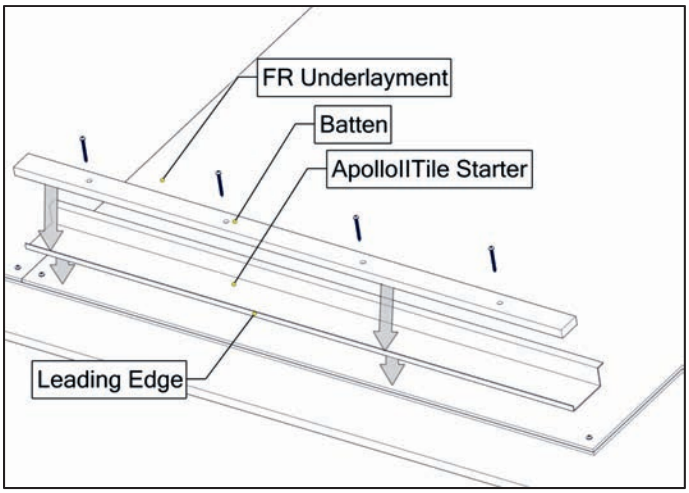


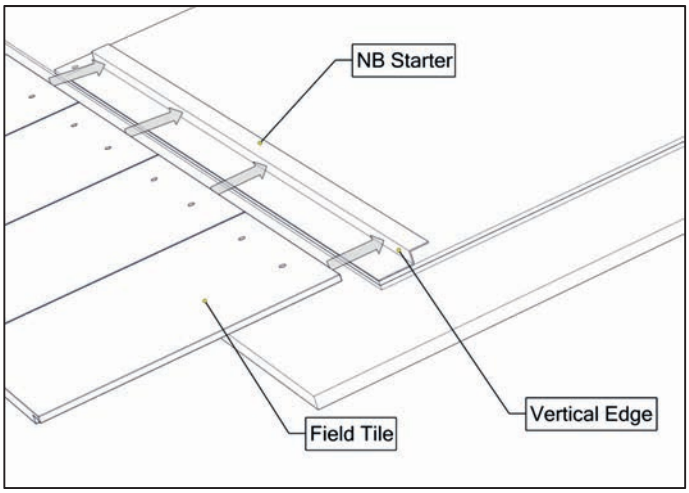


In order to attain a Class A Fire Rating, install a single layer of **FR Underlayment** using 4 fasteners, one in each corner. Fill the *Underlayment Area* vertically and horizontally.

STEP 2 – Install Starter

A **Starter** is needed to hold down the leading edge of the first course of PV Tiles. Use one **Starter** per PV Tile. Install **Starters** and **FR Battens** together one course below the *PV Array* using 4 fasteners and positioning the batten against the *Leading Edge* of the **Starter**. Space adjacent **Starters** horizontally a minimum of ½" to allow for proper drainage.

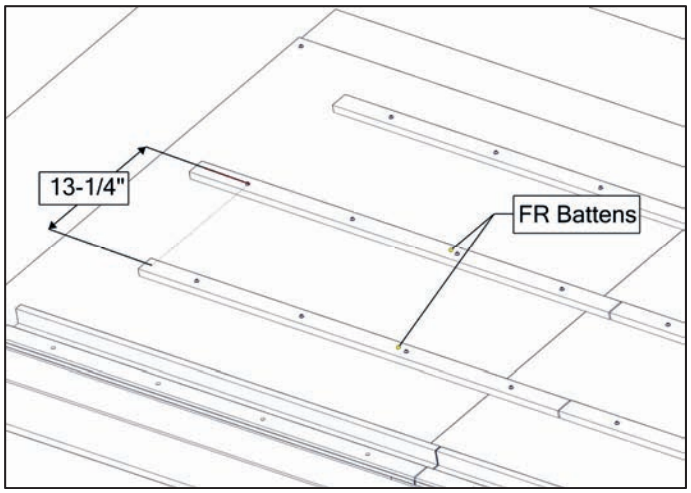




If installing the Apollo Tile II™ System without using battens, be sure that the first course of **Field Tiles** is installed against the *Vertical Edge* of the **NB Starter**. Fasten the **Field Tiles** and **NB Starter** together one course below the *PV Array.* Skip to ***STEP 5***.

STEP 3 – Install FR Battens

Install **FR Battens** per standard trade practices, spacing the battens vertically to create an exposure of 13-1/4" for the **PV Tiles**. Space adjacent battens horizontally a minimum of ½" to allow for proper drainage.

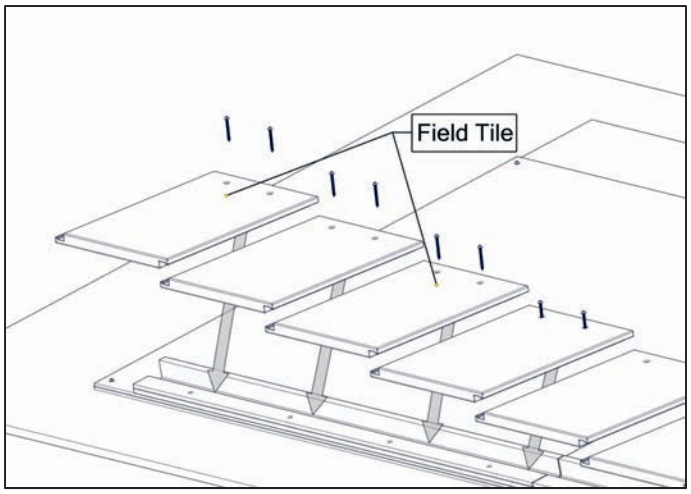


NOTE

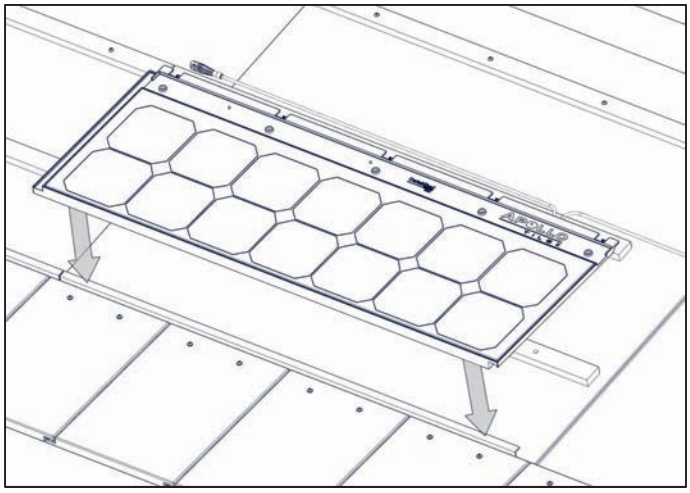
To avoid shading and water intrusion, be sure to maintain a 13-1/4" exposure for each course of **PV Tiles**.

STEP 4 – Install Field Tiles

Install **Field Tiles** below the *Array Area.*

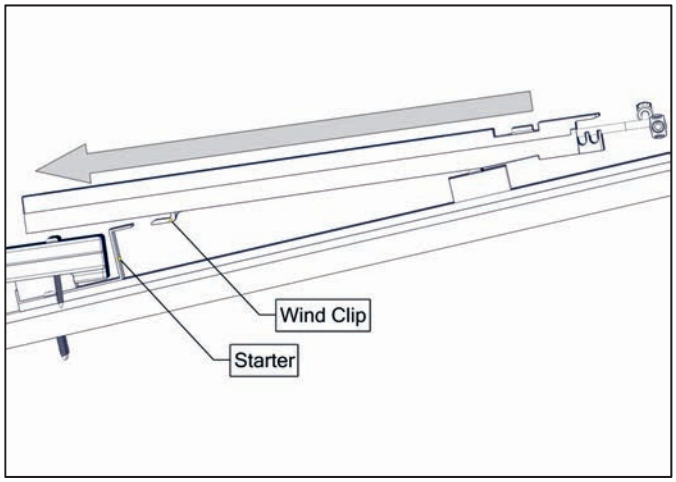


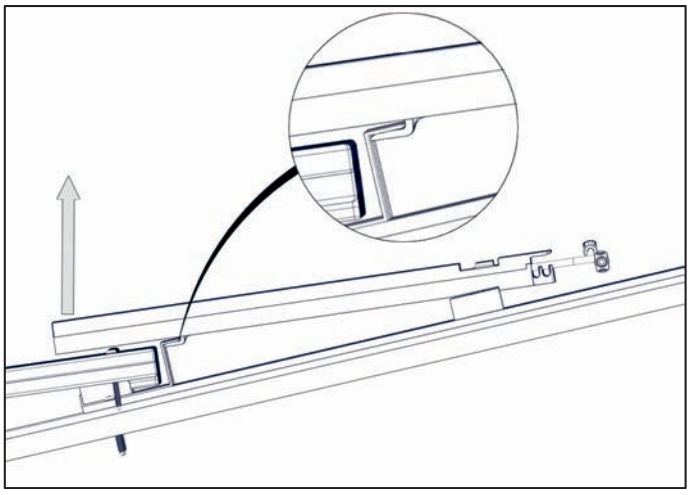
STEP 5 – Install the First Course of PV Tiles



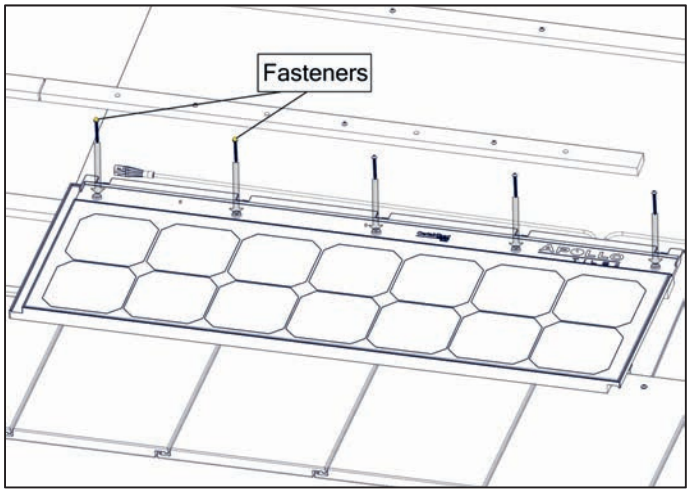
Start at the lower right corner of the *Array Area*.

Slide the **PV Tile** down so that the *Wind Clips* are fully engaged with the **Starter**.





Lift up on the front edge of the **PV Tile** to ensure proper engagement of all the *Wind Clips*.



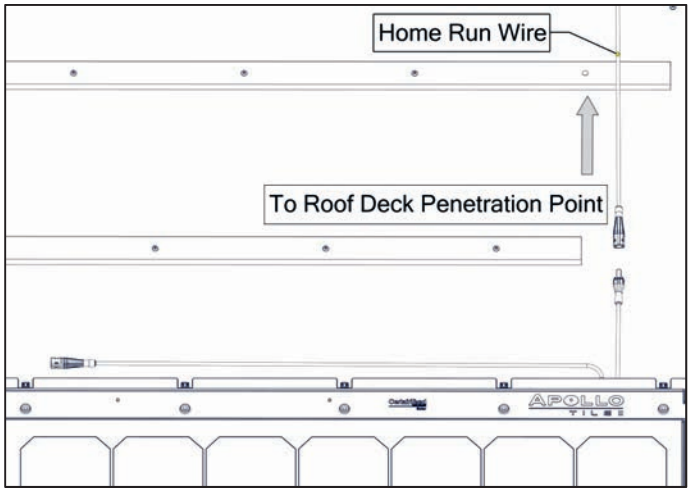
Attach the **PV Tile** using five (5) fasteners in the molded locations.

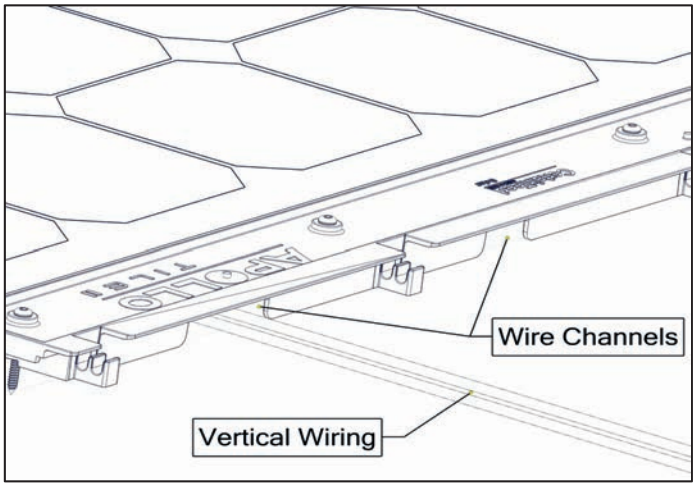
NOTE

Use minimum #8 x 2-1/2" corrosion resistant screws [corrosion resistance equivalent to ASTM A641, Class A]

STEP 6 – Homerun Wire

Attach a **Homerun Wire** to the first **PV Tile** and run it to the *Roof Deck Penetration Point*.





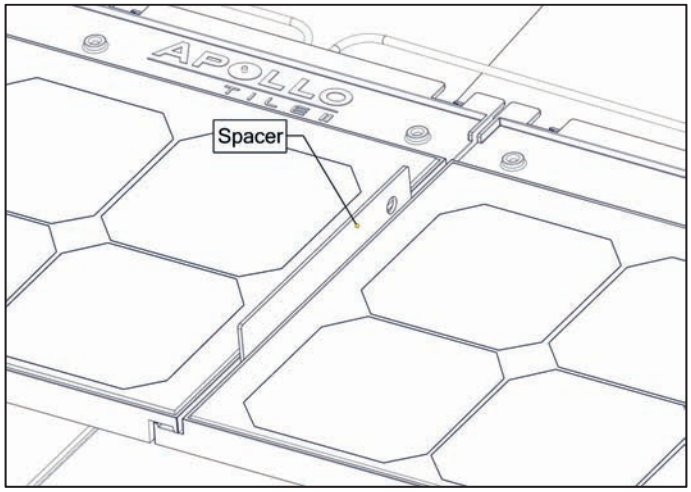
Utilize wiring channels created in the **PV Tile** frame in order to run vertical wiring such as **Homerun Wires**.

CAUTION

As **PV Tiles** are installed, ensure wires do not become pinched between the **PV Tile** frame and the **FR Battens** or deck.

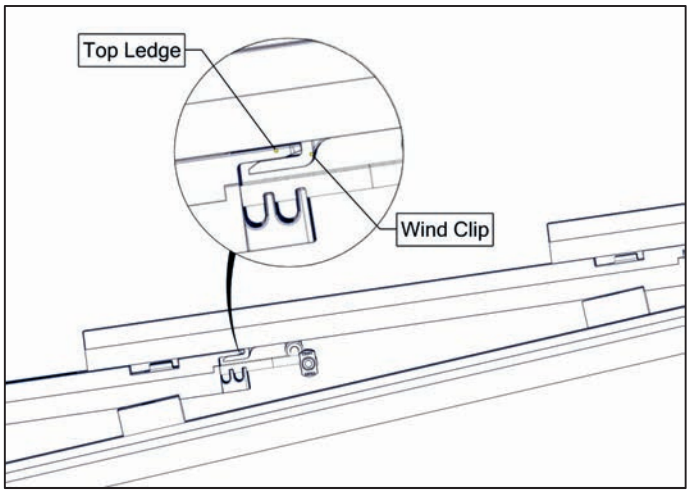
STEP 7 – Continue Installing PV Tiles

Use the **Gap Spacer** provided to set an expansion gap between the each tile.



IMPORTANT

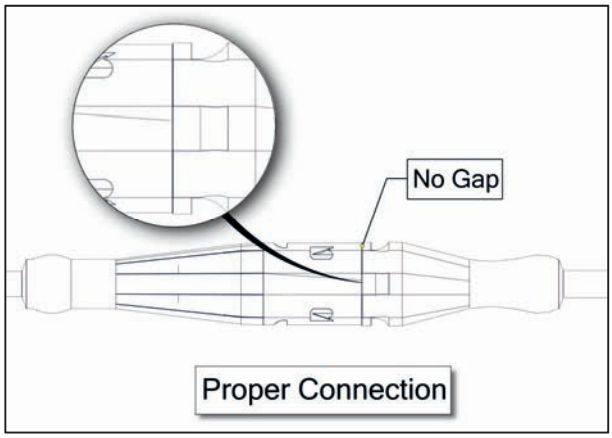
This gap is necessary to allow for **PV Tile** frame expansion. Ensure that the **Gap Spacer** is not bent or deformed to ensure proper spacing.

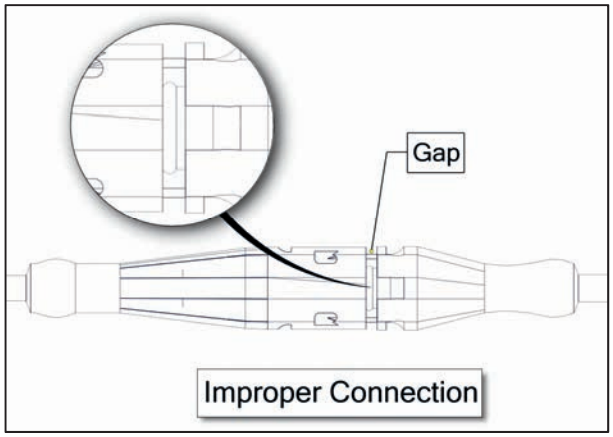


Ensure that the *Wind Clips* of the **PV Tiles** are fully engaged with the *Top Ledge* of the **PV Tile** below.

STEP 8 – Wiring the PV Tiles

PV Tiles are connected using male-female, positive and negative connectors. Plug the connectors together until they lock, to ensure that they are fully mated.





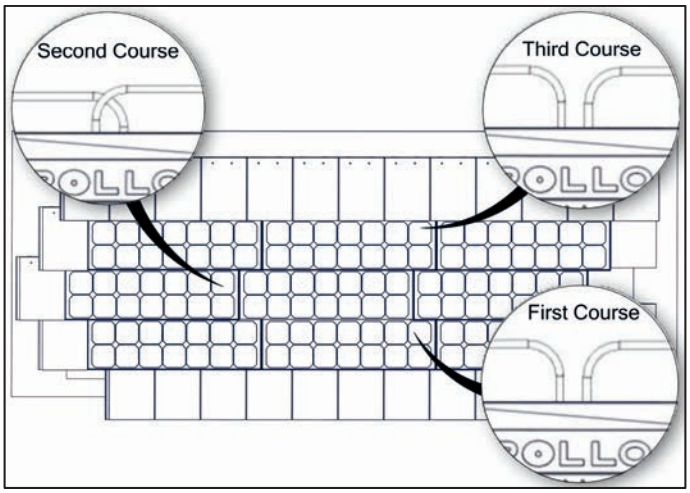
CAUTION

Ensure that connectors are completely engaged and locked by gently attempting to pull them apart.

NOTE

Use the **PV Connector Key** to open connectors if PV Tiles need to be rewired.

Although the **PV Tiles** are installed from right to left, the wiring should be done in an "S" pattern. This means that the polarity of the connectors will have to be reversed for every even course. To do this, simply cross the wires as they exit from the upper portion of the **PV Tile**.

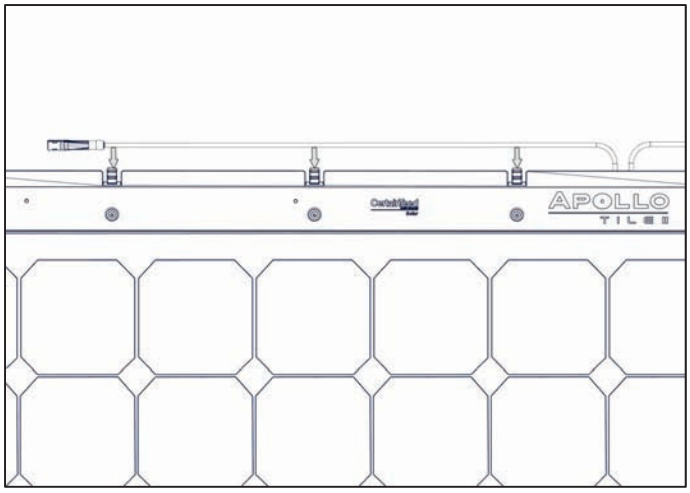


CAUTION

When making vertical connections to continue a string at the end of a course, ensure that the vertical wire is not pinched as it is covered with a **PV Tile**. To do so, gently push/pull the wire to verify that it moves freely.

IMPORTANT

If the array contains multiple strings, ensure that you are aware of where one string ends and another begins through prior consultation of your electrician's *Stringing Diagram* (sample shown in Appendix B).



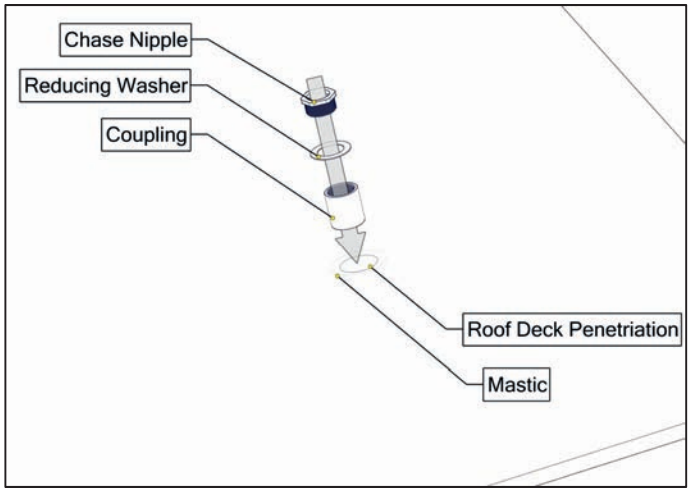
Once fully connected, insert the wires into the clips which project from the rear of the **PV Tile**.

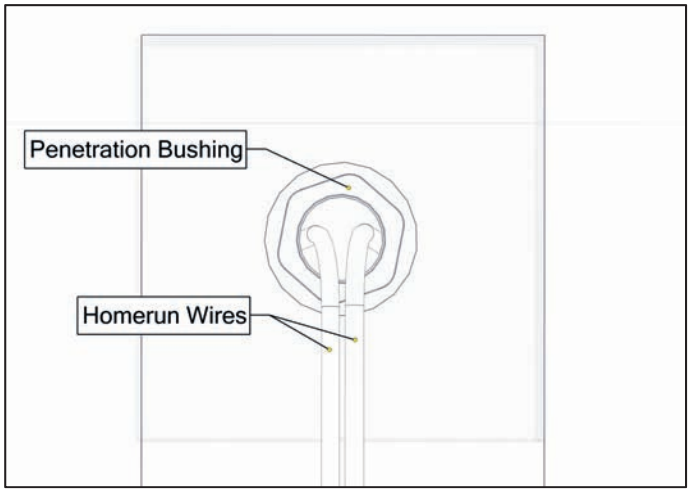
IMPORTANT

It is important to test each course of **PV Tiles** and each string of **PV Tiles** as they are being installed. Refer to Appendix A for instructions on testing each course and string.

STEP 9 – Create Roof Deck Penetration

Using a 1-3/8” hole saw, drill a hole at the *Roof Deck Penetration Point*. Assemble the *Chase Nipple*, *Reducing Washer* and *Coupling* to create a **Penetration Bushing**.





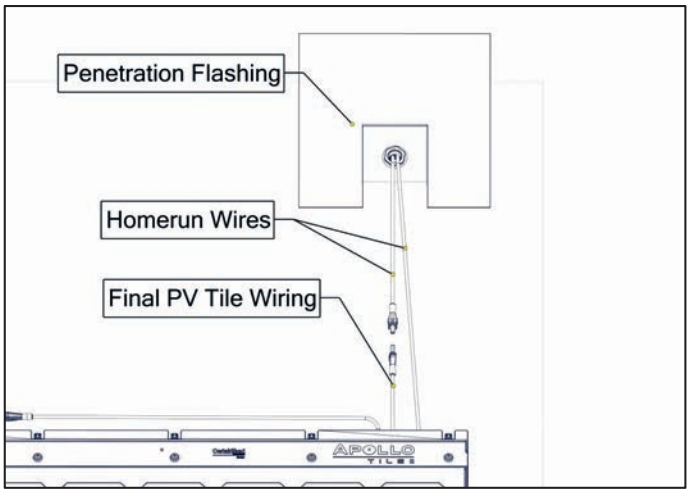
Apply high quality elastomeric, urethane, or roofing mastic meeting ASTM D4586 Type II around the **Penetration Bushing** and press into the hole. Run the **Homerun** wires through the **Penetration Bushing**.

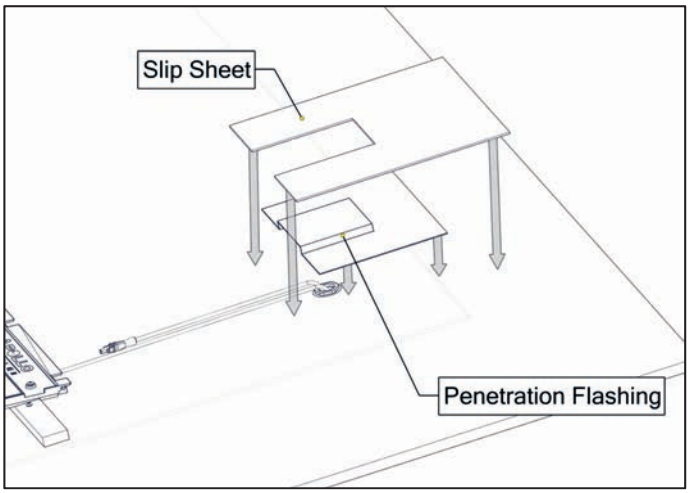
CAUTION

Ensure that cut or exposed ends of **Homerun** wires are capped with wire nuts or electrical tape to prevent arcing.

STEP 10 – Flash Roof Deck Penetration Point

Install the **Penetration Flashing** to cover the *Roof Deck Penetration Point* using a minimum of one fastener in each corner. The **Penetration Flashing** should be centered over the **Penetration Bushing**.





Cover the upper flange of the **Penetration Flashing** with a slipsheet which extends approximately 2” laterally past the edge of the **Penetration Flashing**. Vertically, the **Penetraton Flashing Slipsheet** should extend high enough to be tucked under the next course of underlayment above the array and overlapped by a minimum of 2”.

Balance of System Installation

Balance of system (BOS) components supplied with the Apollo Tile II™ system include an inverter and Homerun wires. 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/or specialty labels.

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

Appendix A

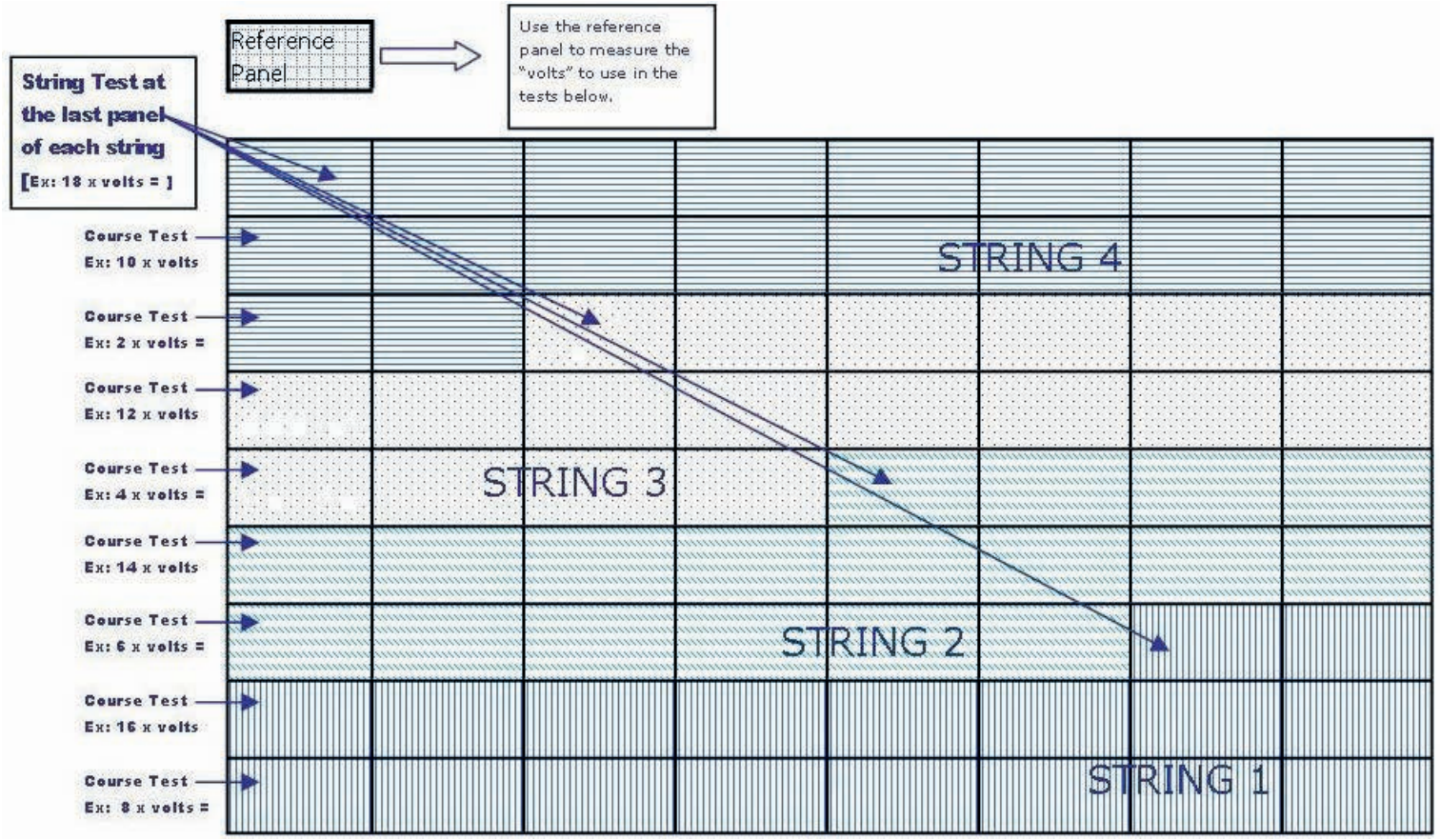
How to Test a Course/String During Installation

1. ***Testing Voltage***. During the installation it is important that you test each course **and** each string of PV Tiles in order to locate any loose connections or broken PV Tiles and replace them without "uninstalling" PV Tiles.

    a. ***Reference Tile.*** Place a PV Tile 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 course, measure the voltage output of the *Reference PV Tile*. 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 course or string. The normal output will be around 9 Volts per PV Tile.

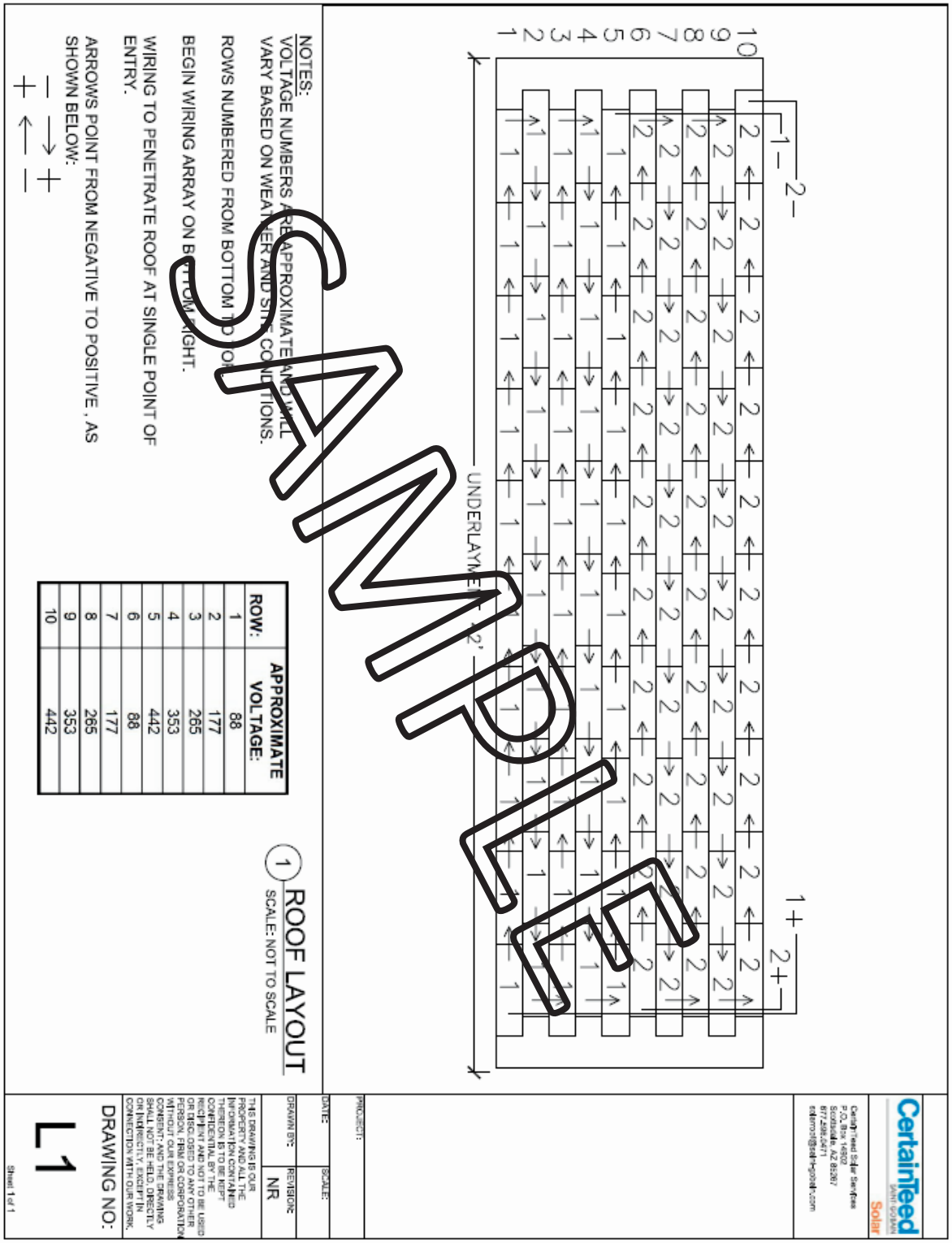
    b. ***Course Test.*** To test a course, connect a multi-meter to the homerun wire from the first PV Tile in the string and the open connector on the final PV Tile in the course. In each subsequent course you will need to add the number of PV Tiles within the string in the prior course(s). If the voltage 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 Tile in the string and the open connector on the final PV Tile in the string. If the voltage measurement is within 2% of the calculated total, the circuit is acceptable.



Appendix B

Sample Stringing Diagram



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