GAF ENERGY

Timberline Solar® ES 2

Nailable Energy Shingles

Quick Start Guide

TLS-ES2

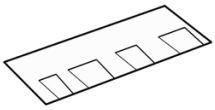
For Trained Personnel Only

ROOFING GUIDE

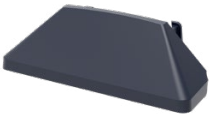
Inventory

INVENTORY CHART

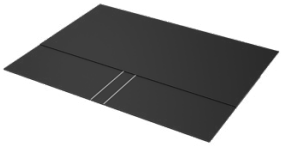
ALIGNMENT JIG



ASPHALT SHINGLE
(SEE PAGE 43)



BOTTOM CAP



BUTTERFLY STEP FLAP

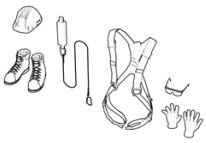
COLUMN RETURN WIRES

DISCONNECT TOOL

ENERGY SHINGLE

FLOATING BRACKET

JUMPER MODULE



PERSONAL PROTECTIVE EQUIPMENT (PPE)

QUICKSTART®

SEALANT
(SEE PAGE 43)

TOP FLASHING

WEATHERBLOCKER™

WIRE COVER

WIRE HOLDER

WIRE COVER HOOK

TOOLS CHECKLIST

TOOLS	MATERIALS
☐ Approved planset	☐ Energy Shingles (Timberline Solar® ES2)
☐ Chalk line reel	☐ Jumper Modules
☐ Compressor & hose(s)	☐ GAF Energy approved asphalt shingles
☐ Nail gun or hammer	☐ Roofing nails
☐ Roofing crayon	☐ Butterfly step flaps
☐ Tape measurer	☐ GAF Energy approved sealant
☐ Utility knife	☐ QuickStart®, peel & stick starter roll
☐ Alignment jig	☐ Top flashing assembly
☐ #2 phillips screwdriver	☐ Right side floating brackets
☐ EVO2 and MC4 disconnect tool	☐ Wire covers and hooks
☐ Caulk gun	☐ Columns return wires
☐ DC voltage meter	☐ Bottom Caps
☐ PPE Gloves	

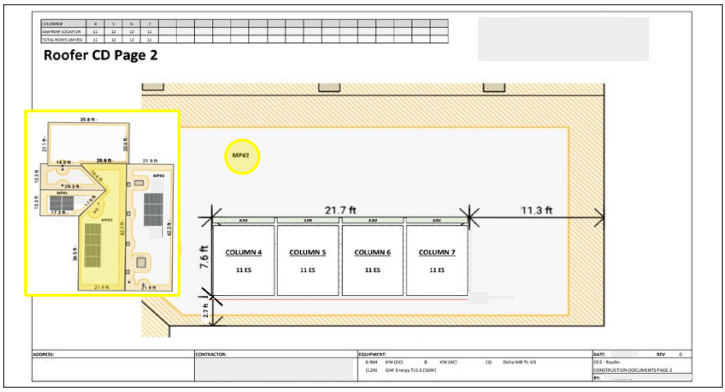
INSTALLATION: The purpose of this document is to summarize the steps necessary to successfully install the roofing scope of GAF Energy's Timberline Solar® ES2. For full video tutorials or to register for a training, visit the **GAF Energy Learning Portal** (gaf.com/learning).

Work should always be done in a workmanlike manner and in accordance with all building codes and standards. Follow all OSHA guidelines and use appropriate PPE while working.

Install

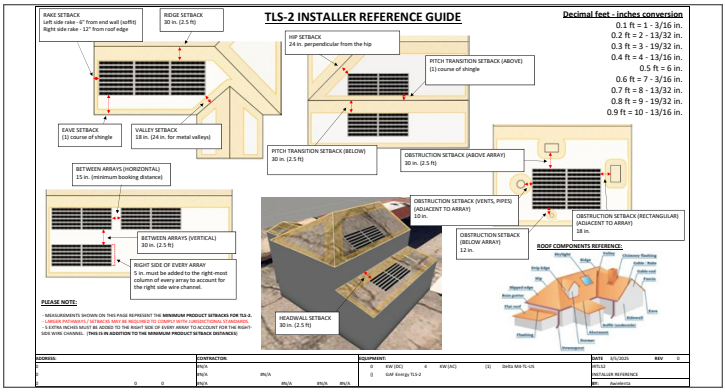
Step 1

Understanding a GAF Energy Plan Set



a Reference roofer cut sheets aka Roofer CD.

NOTE: Visit the **GAF Energy Learning Portal** for the full tutorial.

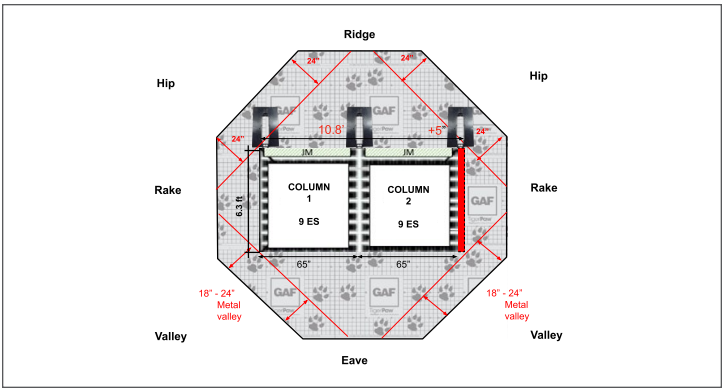


b Reference minimum product setbacks page.

NOTE: Product setbacks from any edge, rake, hip or valley are 18" or 24" if it's a metal valley.

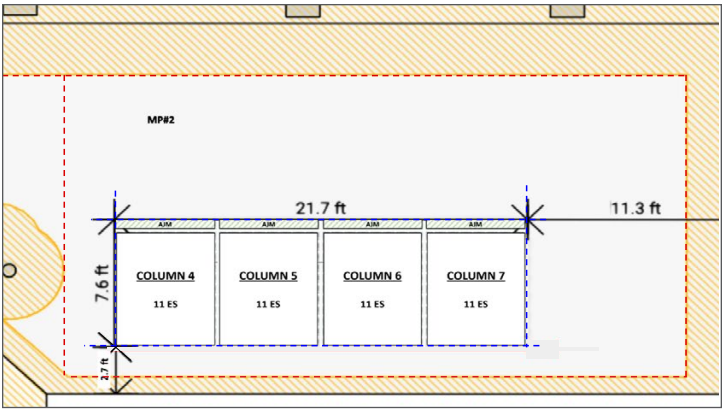
Step 1

Understanding a GAF Energy Plan Set



c Identify setbacks, restrictions and tolerances on mounting plane (MP)

NOTE: Fire setbacks typically 18-36" from any edge, rake, hip or valley.



d Use chalk lines for visual representation on the roof

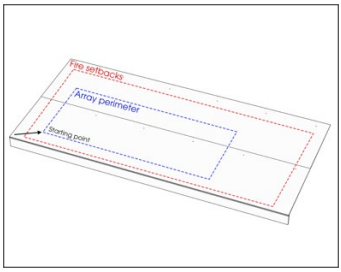
NOTE: Download planset on cell phone or print it out

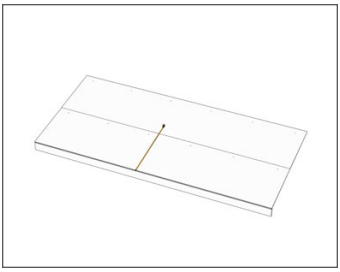
STOP

NEVER install Energy Shingle (ES) wire channels over a rafter to allow attic penetration and to prevent other wire channels from landing over rafters. The left 4-¼" of the ES is the wire channel.

Step 2

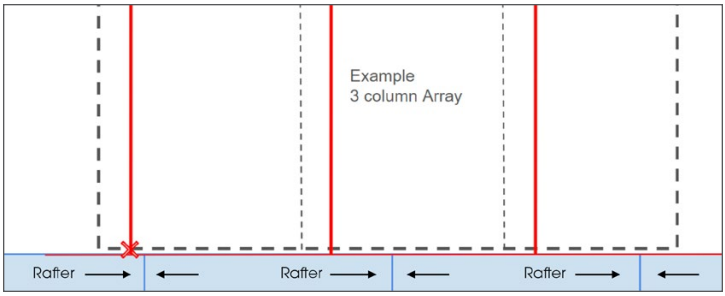
Array Perimeter and Asphalt Shingle Setup





a Locate and mark corners and starting points of each array to make sure they safely fit on the MP, avoiding fire setbacks and obstructions.

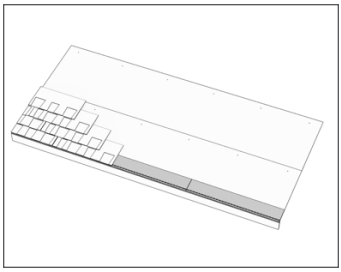
NOTE: Always double check your measurements to prevent installation trouble down the line.

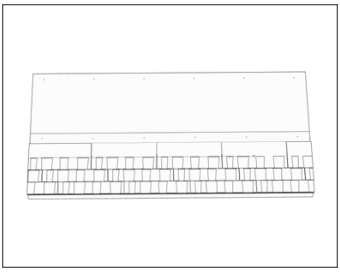


b Never install the wire channels of TLS over a rafter or structural member. Confirm fit using the following equations:

- **i.** Horizontal (# of columns x 65”)+5” (for right side wire channel)
- **ii.** Vertical (# of ES rows x 7-9/16”)+30” (for Top Flashing)

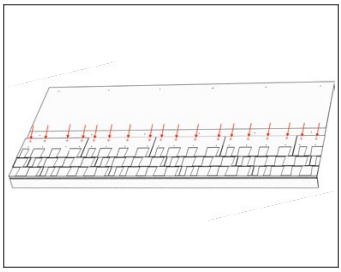
Step 2
Array Perimeter and Asphalt Shingle Setup



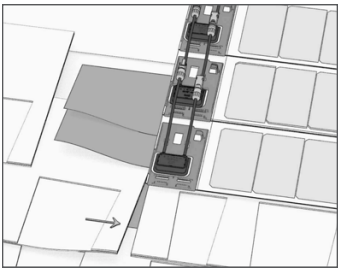


c The array must start on at least one full course of asphalt shingles. Install asphalt shingles up to the array starting point following the manufacturer's installation guidelines.

NOTE: Follow asphalt shingle manufacturer's offset recommendation



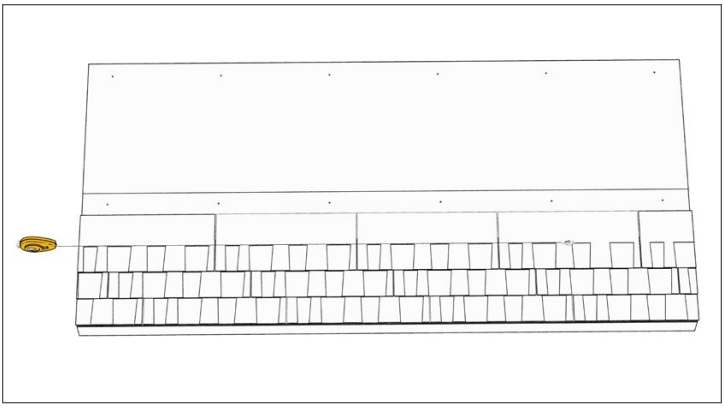
d "High Nail" the headlap of each asphalt shingle in the row directly below the first row of ES.



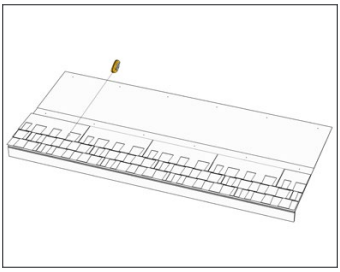
e If there is a butt joint within 8" of the bottom left or right corner of the array, install a butterfly step flap (step flap) underneath that butt joint 2" up from the reveal. Do this BEFORE installing the ES.

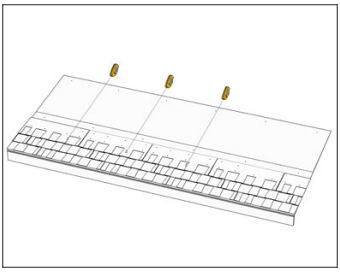
NOTE: Honorable mention: A short course means that the asphalt shingle reveal along the sides of the array do not align. Short courses will not extend outside the top or bottom of the array. Short courses below the array will only be made by an ES sitting lower than the reveal of the asphalt shingle below. Refer to the **GAF Energy Learning Portal** for the full tutorial.

Step 3
Array Layout



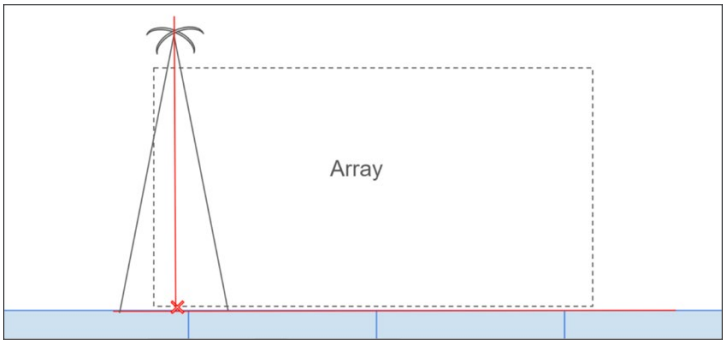
a Snap a straight horizontal chalk line, your starting line, across the asphalt shingle reveal below the array to align the first row of ES.





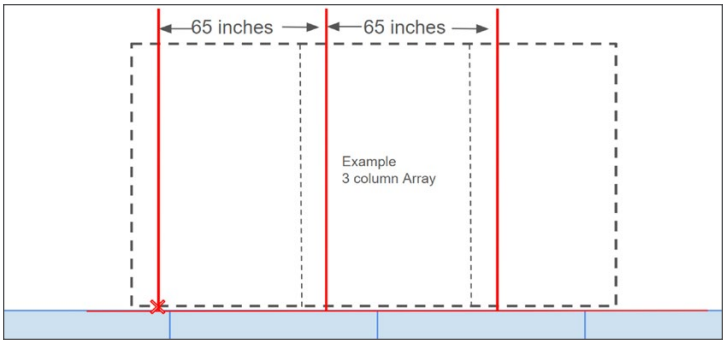
b Snap a chalk line from the starting 6" mark through the top mark of the array perimeter. Since the top flashing is 22", ensure the chalk lines go 2' past the top of the array. Measure and mark 65" increments from the first vertical chalk line across the top and bottom of the array for each column, plus an additional line for the right side wire channel and floating brackets (see step 8d).

Step 3
Array Layout



c Use one of the two methods to create alignment lines on each MP. Visit **GAF Energy's Learning Portal** to watch the full tutorial.

- **i.** 3,4,5 Method aka Pythagorean's Theorem
- **ii.** Pendulum Method

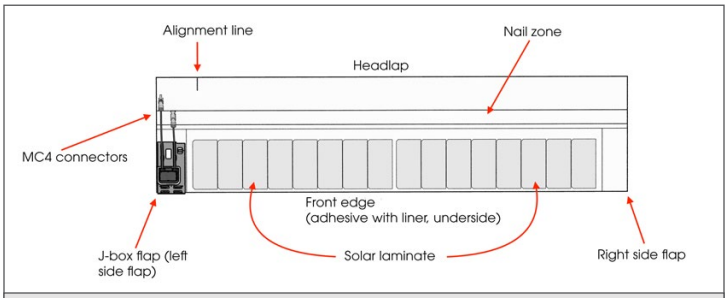


d Repeat process on every MP with TLS.

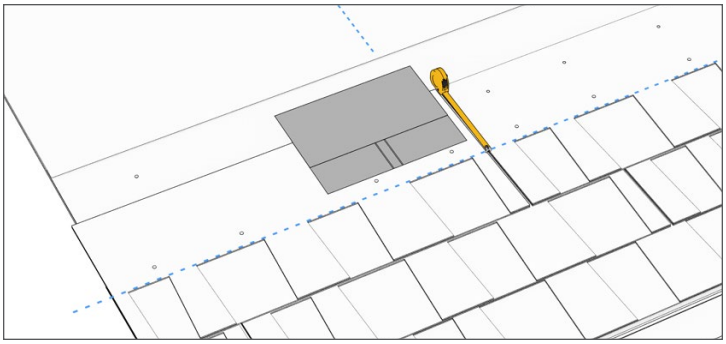
NOTE: Using the Pendulum Method for this example

Step 4
First Energy Shingle

NOTICE: Prior to installing the first ES, complete the layout, install asphalt shingles up to the array and snap horizontal and vertical chalk lines. It is CRITICAL that the first column is installed square and straight to the MP, it will be the source of truth and will be referred to for any additional columns in the array.



This diagram is shows the features of the ES component.

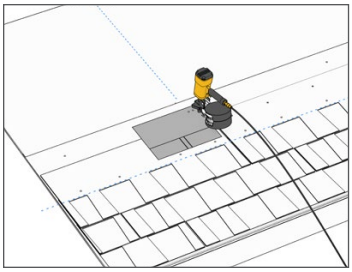


a Install the first step flap by aligning its bottom edge 2" up from the asphalt shingle reveal and aligning the step flap's left center line 6" to the left of the first vertical chalk line.

NOTE: On a single column array, step flaps are installed on both left and right sides. On the right side, align your first step flap with the edge of the right side flap of the first ES.

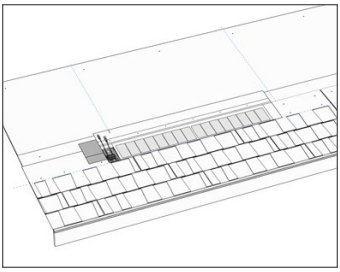
PRO TIP: Step flaps can be installed after their adjacent ES is installed as long as the outside nail of the ES is not within 6" of the laminate edge.

Step 4
First Energy Shingle

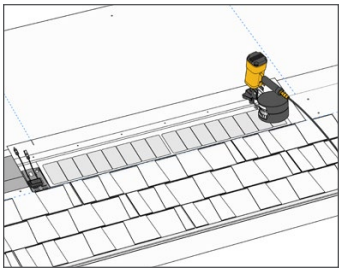


b Secure with two nails in the top right corner, always under the ES.

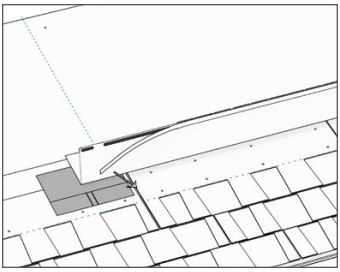
NOTE: Asphalt shingle butt joints less than 8" from the bottom left or right corner of the array require an additional step flap to flash the joint.



c Install the first ES over the step flap by aligning the alignment mark on the ES headlap with the first column's vertical chalk line and aligning its bottom edge with the front edge horizontal chalk line.



d Secure with 6 evenly spaced nails in the nail zone above the glass portion of the laminate.

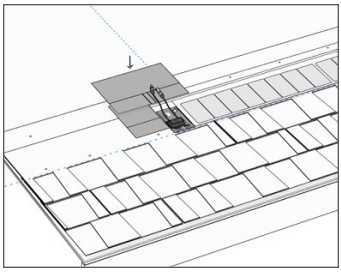


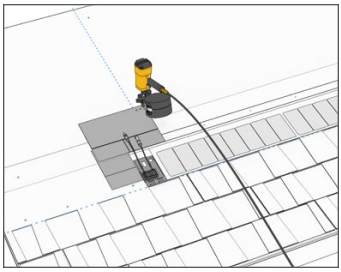
e Lift up the ES, peel the front edge release liner off and set it back in place.

STOP

DO NOT nail the ES above the Junction Box (J-box) or right side flap

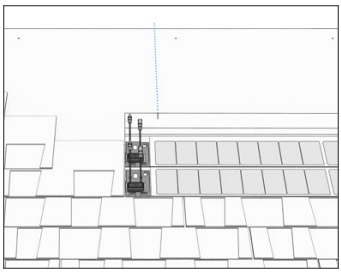
Step 4
First Energy Shingle

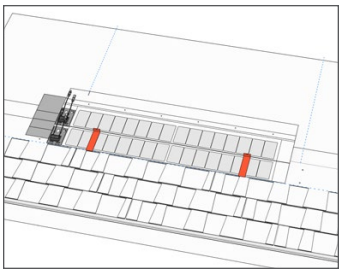




f Position the next step flap over the ES headlap and align the step flap 2" up from the reveal of the ES and align the step flap LEFT centerline with the left side of the ES. Secure with two nails in the top right corner.

REMINDER: Install a step flap underneath EVERY ES and asphalt shingle butt joint on the left AND right edges of the array. Every ES and asphalt shingle joint must always have a step flap underneath.

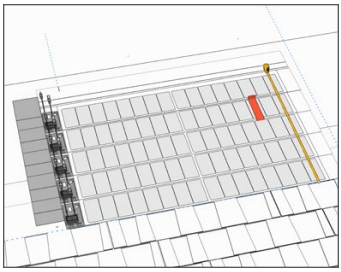




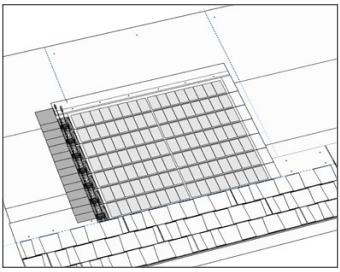
g Align the next ES in place using 2 alignment jigs on each side of the ES to set the north-south reveal. Align the mark on the ES headlap with the first vertical chalk line to set the east-west reveal. Nail using 6 evenly spaced nails in the nail zone. Lift up and peel the front edge release liner and set back in place.

NOTE: The first column will be installed using 2 alignment jigs to set the north-south reveal of each ES. All other columns get installed using one alignment jig on the opposite side of the last column, while visually aligning the other side with the bottom glass edges of the adjacent ES columns.

Step 4
First Energy Shingle



h At the 4th or 5th row, measure from the front edge of the array (bottom ES) on the left and right side to the last installed ES to ensure alignment.

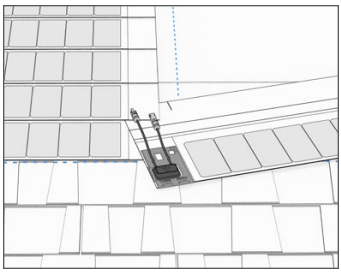


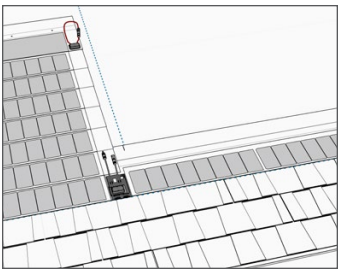
i Repeat the measure and align process every 4th or 5th row while installing the entire first column of ES with step flaps in between.

NOTE: Adjust the reveal on the left or right side of the ES to match whichever side is greater with ⅛" increments max. If more is required, break it up among multiple rows and keep an eye on jig placement.

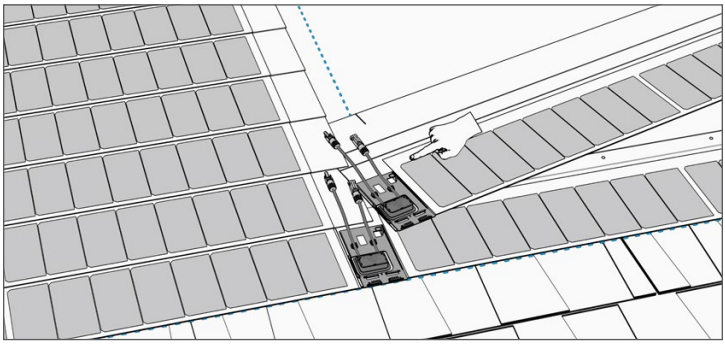
Step 5
Remaining Columns

NOTICE: For the second column and on, only one alignment jig is needed on the right-side of each row to set the north-south reveal. The left-side will be aligned visually referencing the previous columns adjacent ES.





a Align the bottom ES to the horizontal and vertical chalk line and nail it in place with 6 evenly spaced nails in the nail zone.



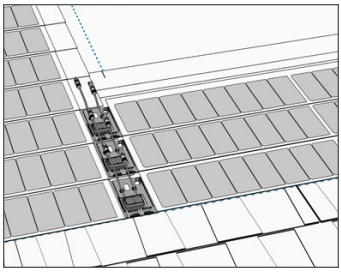
b Align the next ES in the column using an alignment jig on the opposite side of the first column while aligning the other side to visually match the adjacent ES column(s). Align the mark on the ES headlap with the vertical chalk line to set the east-west reveal. Secure with 6 nails in the nail zone.

REMINDER: Remove all the front edge release liner from all ES

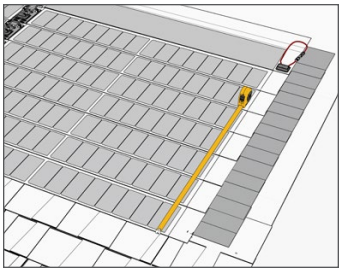
STOP

If this is the rightmost column (the column that will have asphalt shingles to the right) ensure step flaps are being installed at the same time as ES placement. Refer to page 19.

Step 5
Remaining Columns

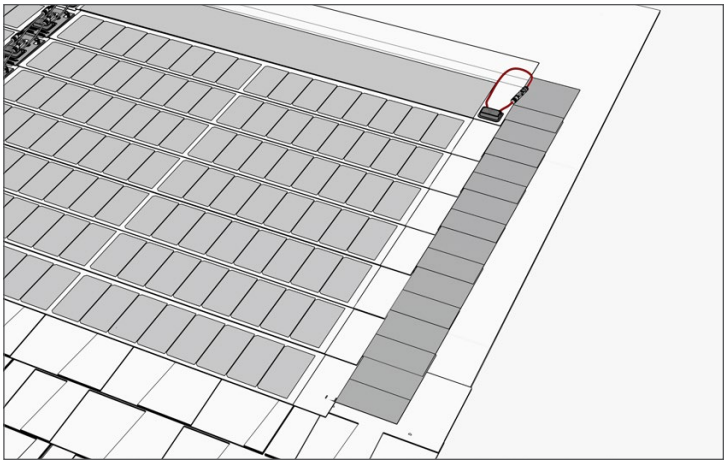


c Properly interweave ES side flaps in a column. Place ES on top of course below, over the flap to the left in the same course and always below any ES in the course above. Repeat this process for all remaining columns in an array.



d At the 4th or 5th row, measure from the front edge of the array to the last installed ES to ensure alignment. If needed, adjust the reveal on the right of the ES to match the first column.

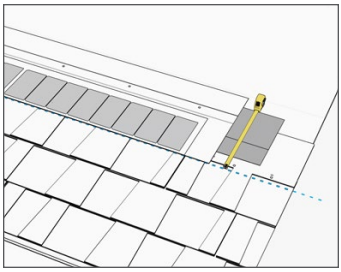
NOTE: If many adjustments are needed then confirm the alignment jig is being used properly.



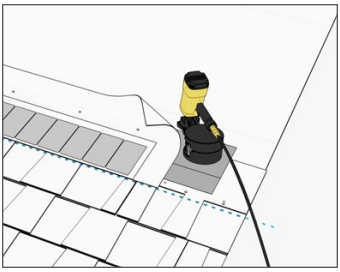
e The rightmost column of every array requires step flaps underneath the right-side flap of each ES, just like the left-side.

PRO TIP: Leave a short strip release liner on the right of the ES, for easier asphalt shingle installation later.

Step 5
Remaining Columns

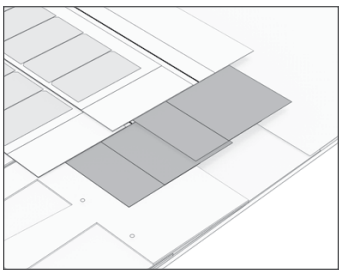


f After installing the first ES in the rightmost column, slide the first step flap underneath the right side flap of the ES, shift it up 2" from the front edge chalk line, and align its RIGHT centerline with the right edge of the ES.

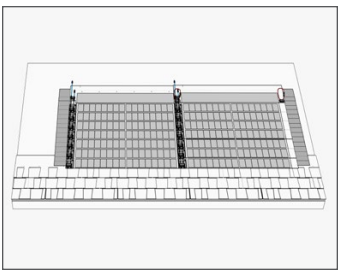


g Secure with 2 nails in the top left corner, under the ES headlap. Whether left or right, the ES should always cover both step flap lines.

REMINDER: Install a step flap underneath EVERY ES and asphalt shingle butt joint on the left AND right edges of the array. Any ES asphalt shingle joint always has a step flap below.



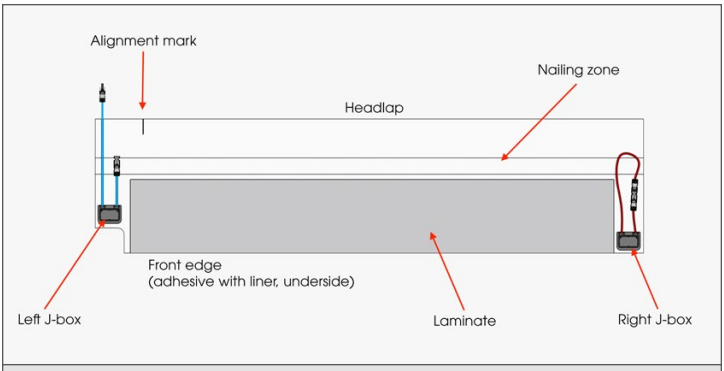
h Prior to installing the second ES in the column, place a step flap on top of the ES headlap just installed, shift it 2" up from the reveal and align the step flap's RIGHT center line to the edge of the ES.



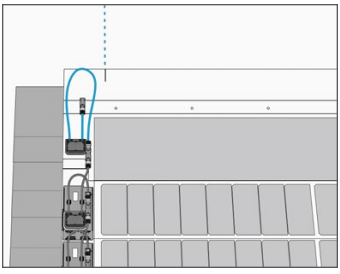
i Repeat this process for the remaining ES in the column.

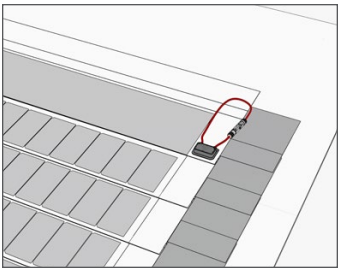
Step 6
Jumper Modules

NOTICE: A jumper module (JM) is a non-power producing shingle that is used to transfer wiring from one column of ES to the next, to allow for series connections, usually at the top of columns.



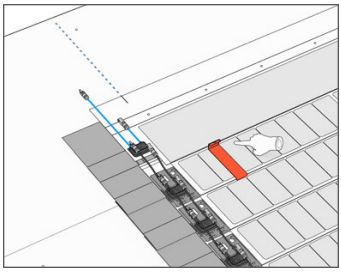
The red right-side J-box wires should come connected on all JMs, allowing them to be treated the same as an ES during installation. In the event the red wires do not arrive connected, connect them.



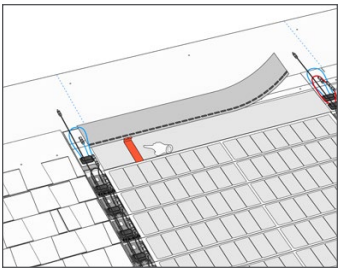


a Install step flaps for JMs at the top of a column, the same as an ES. Cover both lines of the step flap with the JM edge.

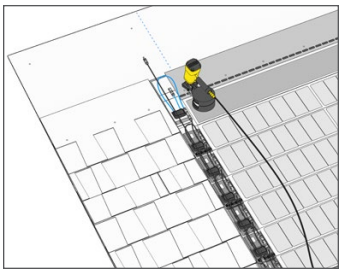
Step 6
Jumper Modules



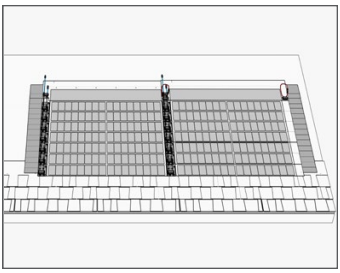
b Align JMs the same way ES are installed, using the alignment jig and vertical chalk lines. Secure with 6 nails in the nailing zone and remove the release liner.



c Install 60" cuts of QuickStart over the headlap of each JM at the top of each column, for asphalt shingle adhesion. Use an alignment jig on either side to align north-south.



d Remove the release liner on the QuickStart and apply pressure to stick it in place. Fasten it with 6 nails along the nail zone of the JM below.

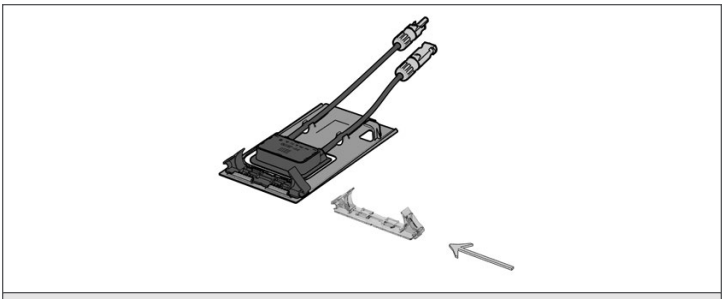


e Once all columns in an array are installed but before asphalt shingles are installed, connect ES and JM wires in each column.

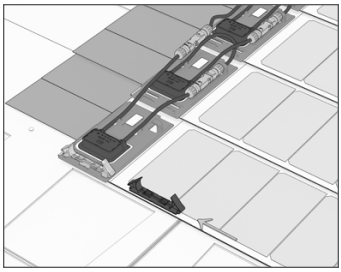
DON'T place QuickStart above J-boxes or over the interior area of the Top Flashing where it could come in contact with wires and connectors.

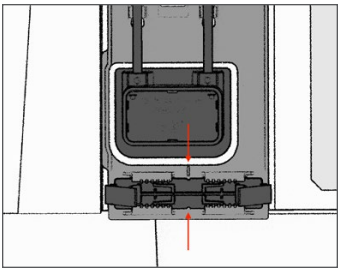
Step 7
Wiring System

NOTICE: Wire cover hooks (hooks) are needed in order to attach wire covers and assist in wire management within a wire channel. Hooks can be installed before or during column wiring.



Hooks are required on every other row of ES and immediately below and/or above a JM.

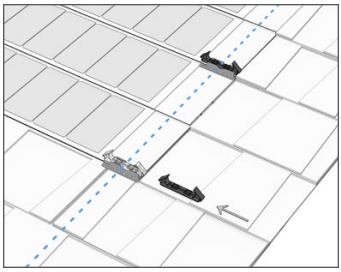


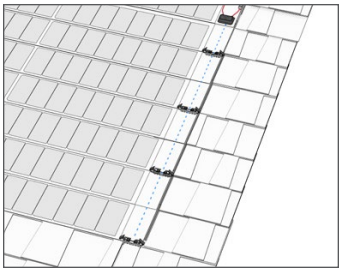


a Going up roof, install hooks on every other row of ES and immediately below a JM. From either side, slide a hook into the center position on the ES base plate. Do this for every wire channel in the array.

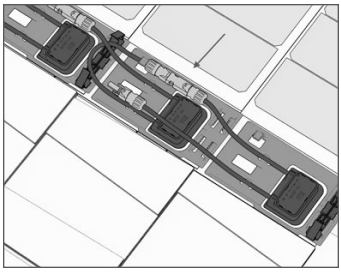
PRO TIP: For easier hook install, remove any debris from the baseplate.

Step 7
Wiring System

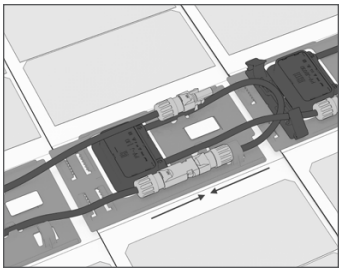




b For the right side of the array, once floating brackets and asphalt shingles are installed, install a hook on each floating bracket.



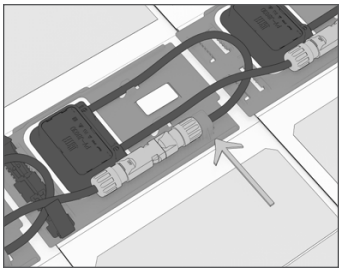
c Wiring: Starting at the second to bottom row of each wire channel, route the (+) connector of the ES underneath the (-) connector from the same J-box and loop the (+) connector down.



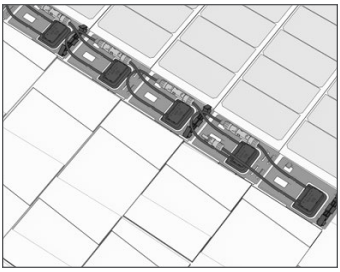
d Connect the downward facing (+) connector with the (-) connector of the ES in the bottom most row. An audible CLICK should be heard. Perform a light tug test to verify connectors are fully mated to each other.

NOTE: Clear any debris out of wire connectors before plugging them, for a safe electrical connection.

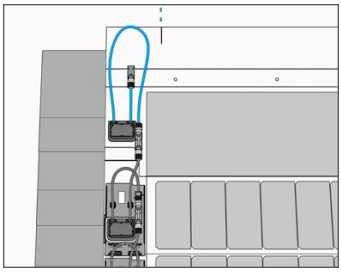
Step 7
Wiring System



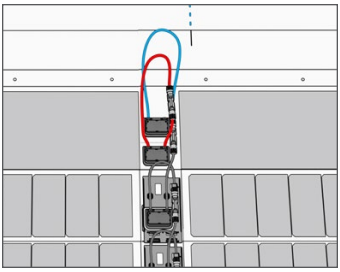
e Place wire loops within the hooks, then use the wire management features to prevent interference when installing Wire Covers.



f Repeat these steps until the entire column is wired together. Always plug the (+) down to the (-) connector below. There should only be one open (+) connector at the bottom most ES and one (-) connector at the top most ES.



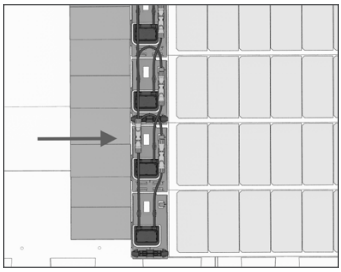
g For JMs, route the blue J-box (+) connector under its (-) connector while looping it back downward to connect it with the (+) connector from the ES in the row below.

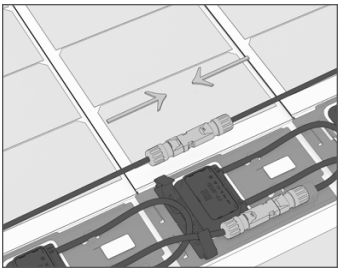


h For a center column wiring with JM at the top, take the blue wire JM (+) connector and plug it down to the ES below. IGNORE THE RED WIRE.

DON'T disconnect JM red wires or plug them into anything else other than themselves.

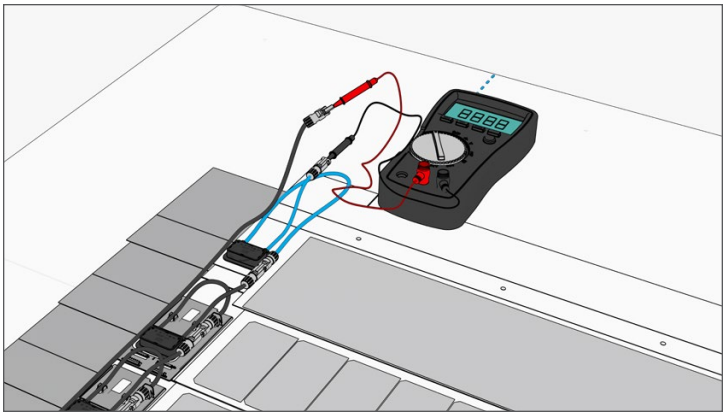
Step 7
Wiring System





i Plug the column return wire into the bottom most ES (+) connector and route it up using the hooks to keep it within the bounds of the baseplate. Column return wire can be routed at the same time as ES to ES connections are made. Column return wires cover 8 rows and can be connected together to reach the top flashing. Always bring the column return wire up inside the top flashing.

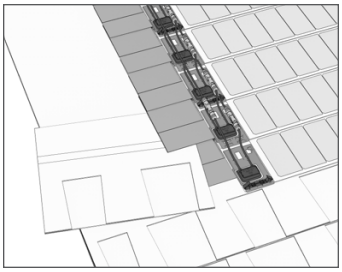
NOTE: The wiring of the right side wire channel will be done by the electrician.



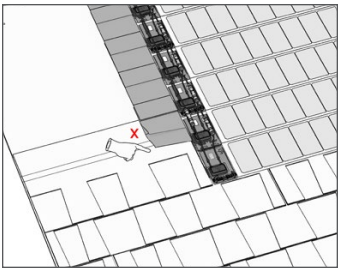
j At the top of the array, verify that the DC voltage matches what is expected. ES are roughly 10V each. JMs produce 0V.

Step 8
Remaining Asphalt Shingles

NOTICE: Maintain proper shingle offset based on the manufacturer's specifications. Do not install any shingle smaller than 6" on the sides of the array. Starting from the bottom, the asphalt shingles will be woven into the step flaps on each side of the array.



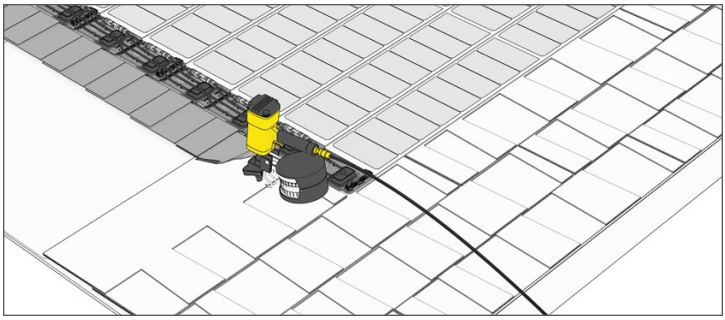
a Start installing asphalt shingles on the left side of the array. Interweave the asphalt shingles with the installed step flaps by aligning the asphalt shingle in position with the reveal below.



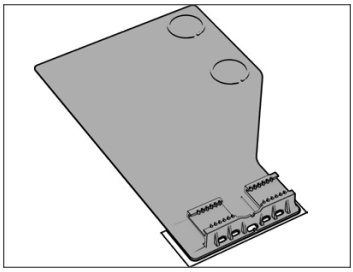
b If a step flap's lower edge is covering anything below the asphalt shingle's nail zone, that step flap goes under the shingle. The next flap above will cover a portion of the asphalt shingle headlap.

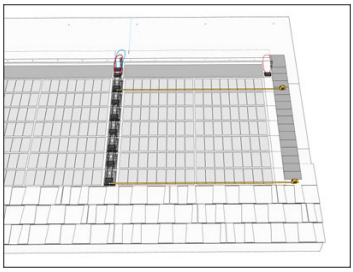
NOTE: Installers will determine the shingle integration/flap weaving based on the size of the asphalt shingle being installed and where the flap lands on the shingle.

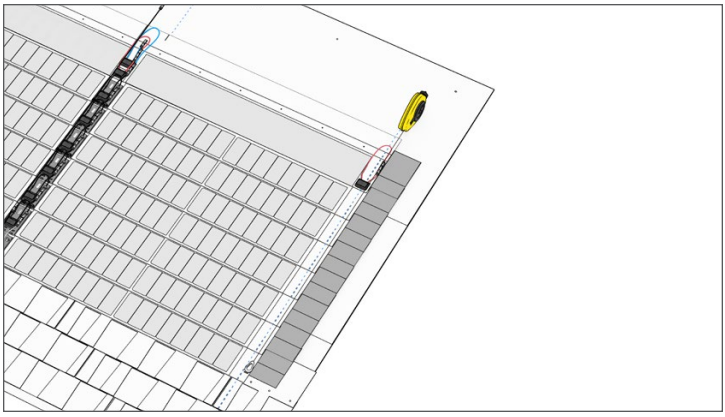
Step 8
Remaining Asphalt Shingles



c Place a high nail on the asphalt shingle underneath the step flap above to eliminate exposed nailheads.

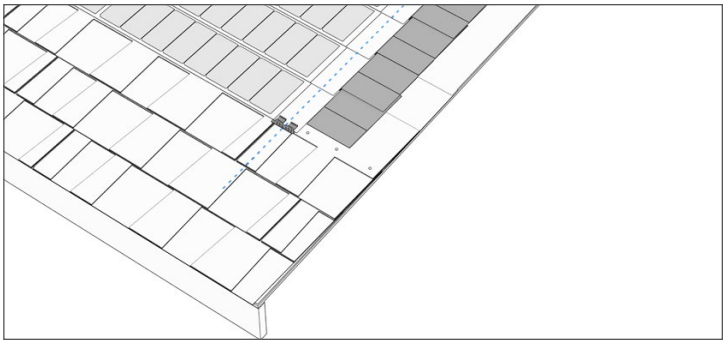




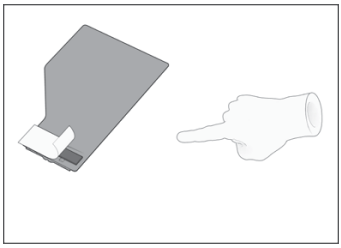


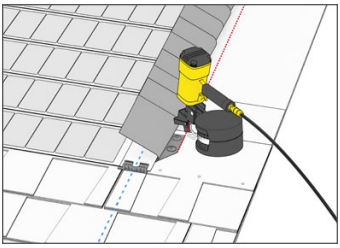
d Floating brackets are required on the rightmost column of an array, adjacent with asphalt shingles. An extra 65" chalk line for the floating brackets should have been snapped during layout. (See step 3b). If the line is forgotten during layout, measure and mark 65" from the center of the last wire channel on top and bottom of column and snap a line to align the center of floating brackets.

Step 8
Remaining Asphalt Shingles

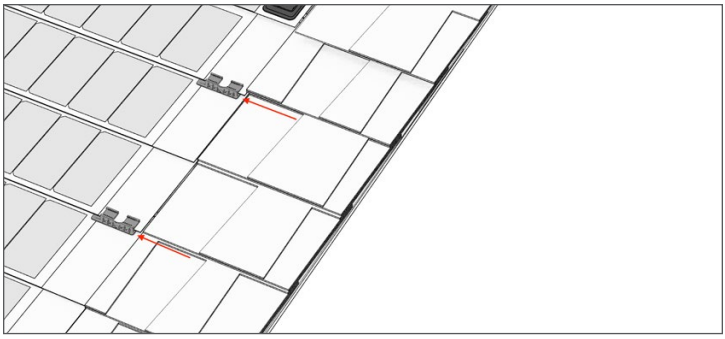


e Starting at the bottom ES row, slide the bracket underneath the ES right side flap and step flap. Align the right edge of the floating bracket to the vertical chalk line underneath the step flap and/or the line on the ES right side flap.



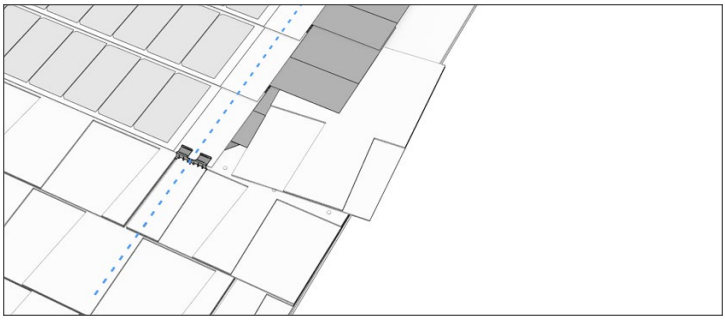


f Remove the release liner and align the bracket with the chalk line(s). Lift the step flap and fasten the bracket in its nailing targets with one nail each.



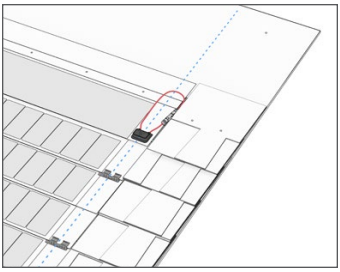
g Continue installing floating brackets every other row of ES on the right side as you install asphalt shingles.

Step 8
Remaining Asphalt Shingles

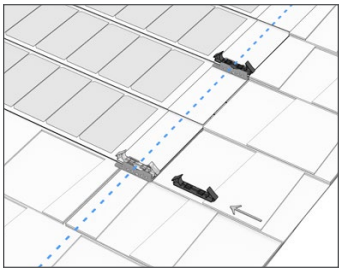


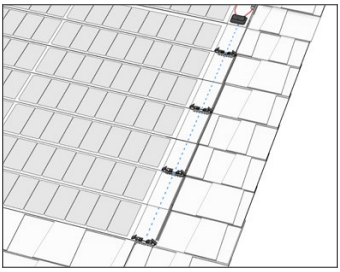
h Interweave the asphalt shingles with the step flaps on the right side of the array just like the left side of the array. Bring the asphalt shingle to the edge of the right side flap. Never leave a step flap exposed or covering the nail zone of the shingle below.

REMINDER: High nail the asphalt shingle under the step flap where it butts the ES.



i Continue installing asphalt shingles along the right side of the array, making sure to interweave shingles with the step flaps all the way to the JM.

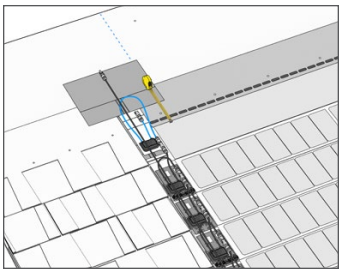




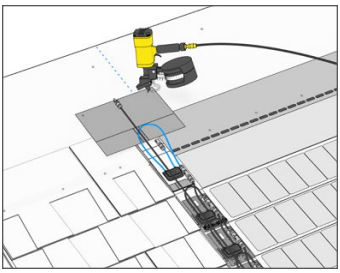
j Add a hook to each floating bracket on the right side of the array.

Step 9
Top of Array

NOTICE: Two step flaps are required at the top of each wire channel and must be installed after asphalt shingles have been installed up the sides of the array, but before the top flashings.



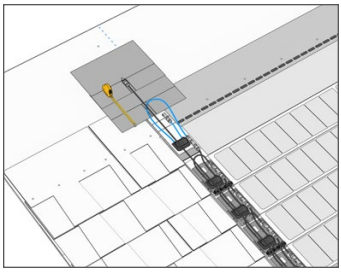
a Center the first step flap with the wire channel and shift it up 5" from the bottom edge of the QuickStart or align it to the top line in the nail zone.

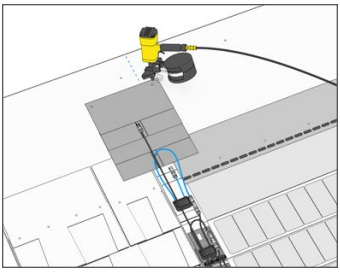


b Secure the step flap by nailing in the top left and right corners.

NOTE: If you did not install QuickStart over the top of the array after installing ES columns, install it now. See Step 6c and 6d.

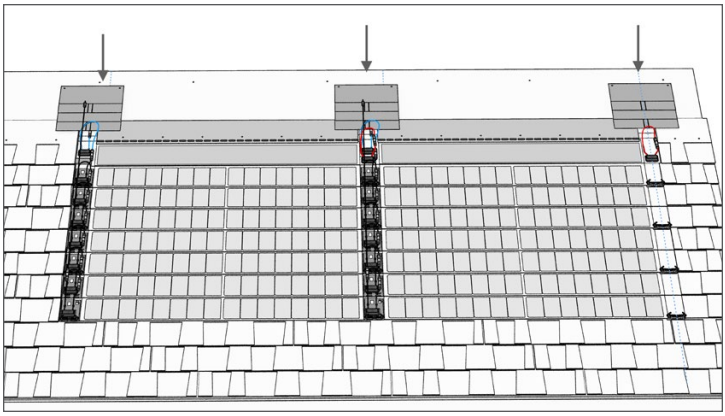
Step 9
Top of Array





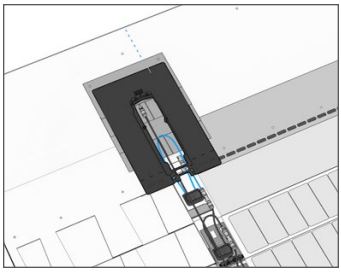
c Install a second step flap on top of the first one. Shift the bottom edge 7" up from the bottom of the first step flap, or the height of an alignment jig.

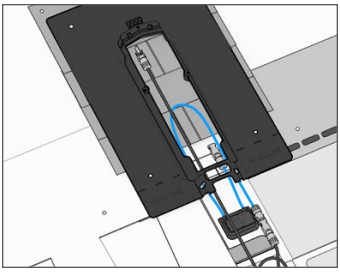
NOTE: Step flaps should completely cover the underside of the top flashing.



d Continue across the top of the array, strategically nailing step flaps at the top of each vertical wire channel, including the right side wire channel.

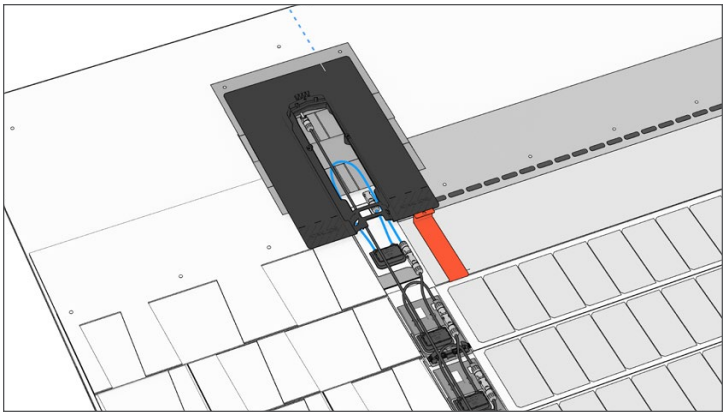
Step 9
Top of Array





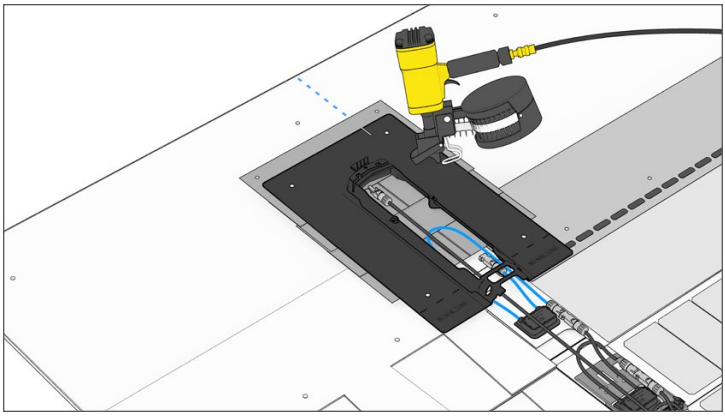
e Starting with the leftmost wire channel, position a top flashing base visually centered over the wire channel. ES, JM, step flaps, QuickStart, and any asphalt shingles should be below. Route the topmost connectors, including column return wire, through the lower opening of the top flashing base.

NOTE: If a short course is needed across the top, install the short course shingles prior to installing the top flashings. Then, install the step flaps and top flashings followed by the remaining courses of asphalt shingles (See step 10).



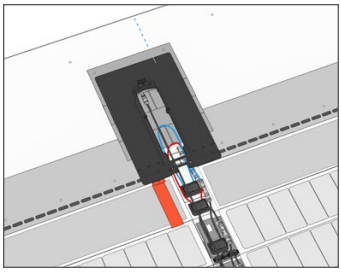
f Align the top flashing alignment mark at the top with the 65" vertical alignment chalk line used for the ES and JM. Align the bottom with the QuickStart, an alignment jig can be used.

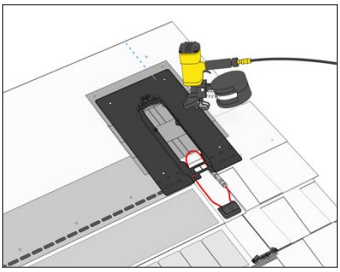
Step 9
Top of Array



g Before fastening, make sure no wires are pinched between the top flashing and the roof deck. Place two nails in each top corner and two nails lower above the "No Nail Zone." Nails will be covered by shingles.

NOTE: Use extra caution to ensure the top flashing is centered with the wire channel and aligned straight.

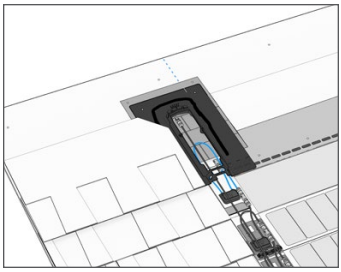




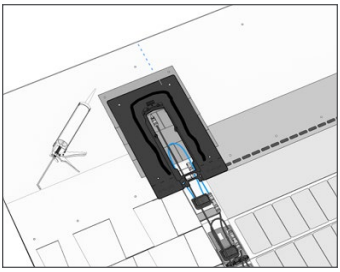
h Continue installing top flashing bases at the top of every wire channel including the right edge.

Step 10
Asphalt Shingle over Top of Array

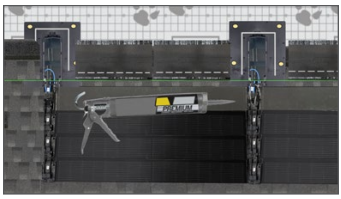
NOTICE: When installing asphalt shingles across the top, if a short course is needed, install the short course shingles prior to installing the top flashings. Then install step flaps and top flashings followed by the remaining courses of shingles.

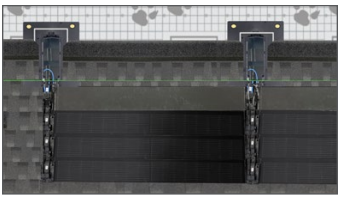


a Once the sides of the array are shingled, asphalt shingles can be installed across the top of the array. Install asphalt shingles on top of the top flashing base flanges and across the top of the array.



b Apply an upside down "U" shape continuous bead of GAF Energy approved sealant to the top flashing.

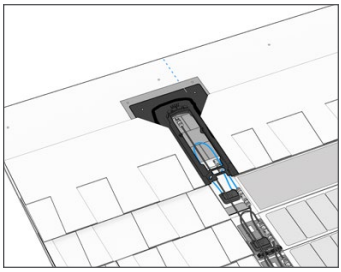




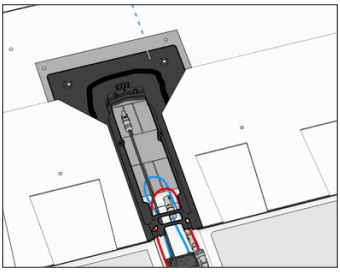
Short courses of asphalt shingles should only be installed between top flashings. Hand sealant is required between the short course and shingle course above.

Step 10

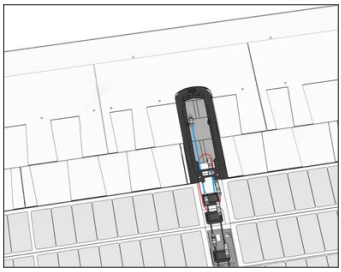
Asphalt Shingle over Top of Array



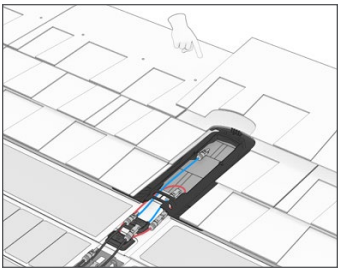
c Install the first course of asphalt shingles above the array around the Top Flashing.



d Cut asphalt shingles around the top flashing base, making sure to leave at least a ½" gap for a water channel. Notch the asphalt shingle corners (dog ear) at the sides of the top flashing to deflect water.



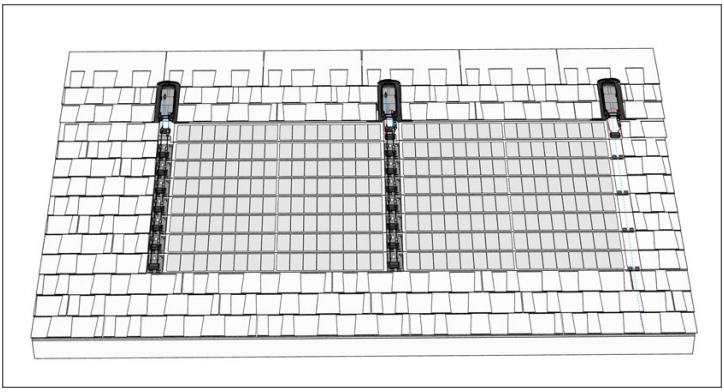
e Shingle around the top flashing as any other rooftop flashing.



f Third course requires minor trimming

Step 10

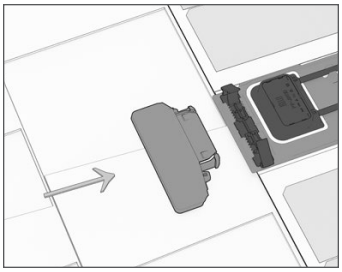
Asphalt Shingle over Top of Array



g Continue installing asphalt shingles across the top of the array.

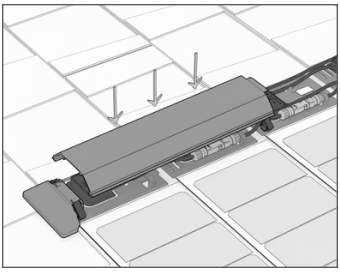
Step 11
Wire Covers

NOTICE: The wire cover system on each column is made up of a bottom cap, one or more wire covers, and a top flashing lid. Wire covers are installed along each wire channel starting from the first row and up to the top flashing. They're installed by snapping onto the hooks.



a At the first row of the first wire channel, slide the bottom cap into the bottom end of the hook until it is locked in place. Tug on the cap to verify engagement. Repeat this step at the bottom of each wire channel.

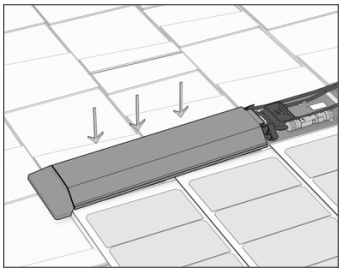
NOTE: Bottom caps will have slight movement around the hook but should not be easily removed once installed.



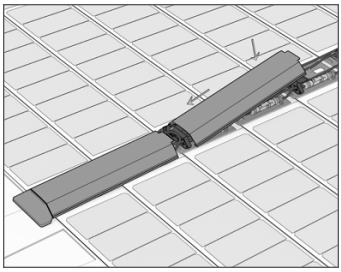
b Install the first wire cover by firmly pressing down on the cover to SNAP it onto the hook on the first row. Perform light tug-test to verify engagement.

NOTE: Wire covers can also be installed by sliding them down over the hooks.

Step 11
Wire Covers

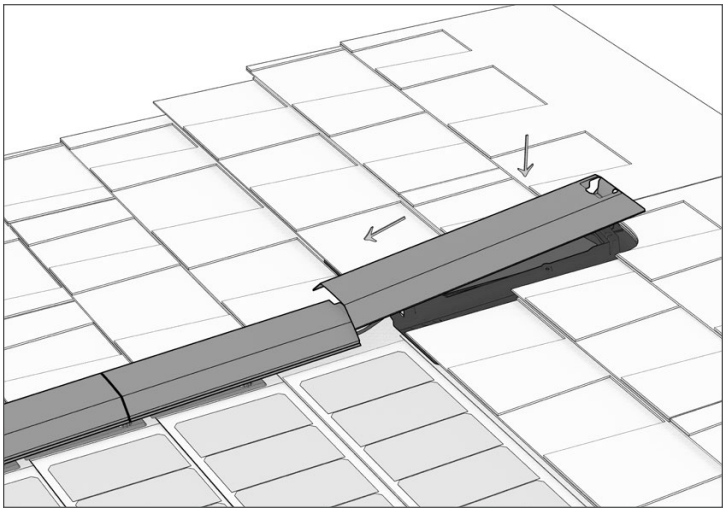


c Slide the wire cover down so there is no gap between it and the bottom cap. If the parts are properly engaged, there should be no bulging of parts or gaps.



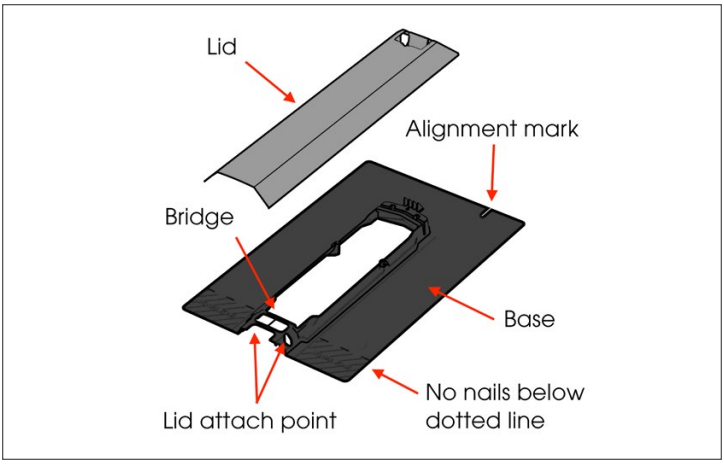
d Install the next wire cover up by sliding the lower end into the top engagement tabs of the wire cover below. Firmly press down to snap wire covers onto the hooks directly below them.

NOTE: Every wire cover should be attached to at least one hook. Two wire covers can share a hook.

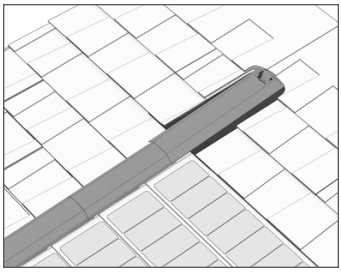


e Repeat these steps until the top most wire cover reaches the top flashing for every column.

Step 11
Wire Covers

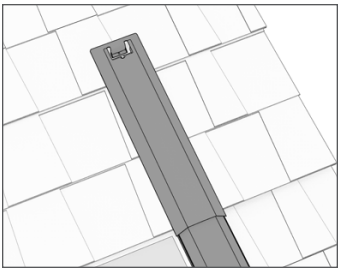


f Hook the bottom portion of the top flashing lid onto the sides of the "bridge" portion of the top flashing base. Line up the top of the top flashing lid with the top flashing base and press down on the top portion to fully engage the lid to the base.



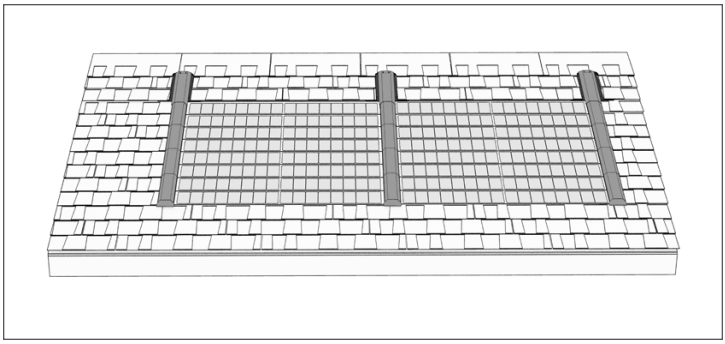
g Ensure the bottom end of the top flashing lid is overlapping the top most wire cover.

NOTE: Leave the provided screw taped to the bottom side of the lid, this is for the electrician.



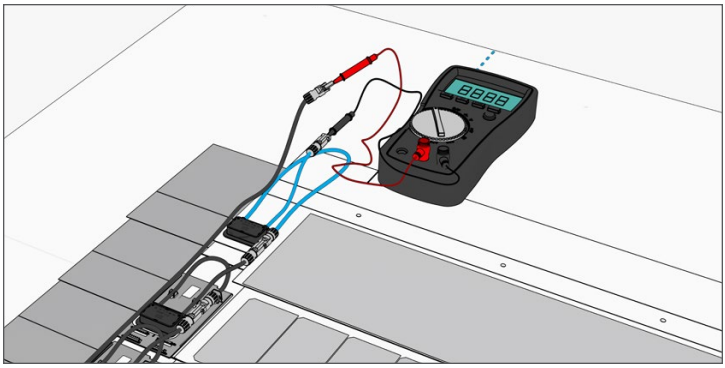
h As a final check, perform a light tug test along the wire channel and top flashing lid to ensure each section of the wire cover is engaged with a hook below.

Step 12
Clean Up & Final Check



a Wipe down ES with microfiber and clear area of trash and debris

b TLS system is aligned with asphalt shingles, as designed



c Voltage check

d Wire covers properly installed

e All product looks clean and undamaged

f Sealant on top flashing

g Release liners removed from ES and floating brackets

Roofing Reference Pages

TERMS AND DEFINITIONS

TERMS AND DEFINITIONS, A-Q
Roofing Reference Pages

ARRAY
A grouping of TLS ESs installed on the roof together with no more than 2' between from any point on the ES. May be referred to as TLS array, ES array, PV array, and solar array. An array may be considered a sub-array when it is one of multiple arrays which make up a single PV string.

ARRAY BOUNDARY
Defined in NEC 690.12(B) as 1' from PV array in all directions. No more than 2' between separated TLS ESs shall be considered within the array boundary and only require a RSD at the conductors exiting the array boundary. The 2' dimension can be taken from an ES to another wire channel on a TLS array.

AZIMUTH
The compass direction a roof plane or PV array is facing (North being 0 and 360 degrees). For example: A PV array with azimuth of 180 is facing south.

COLUMN RETURN WIRE
A type of 'PV wire' cable with factory made EVO2 or MC4 connectors on each end, used to bring the bottom most ES connection to the top of the column. Available in varying lengths and provided by GAF Energy.

CONTROL LINE
Horizontal control lines, snapped parallel to the eave, are used to keep ES rows straight.

FIRE SETBACKS
Areas of the roof that solar modules must not be placed within to allow firefighters to safely walk on the roof when responding to building fire.

FLASHING
Installed around a penetration or along the roof's edge, to keep water from seeping into the layer below. In addition to the roof's perimeter or at penetrations, flashing can also be used on walls, valleys, drains, expansion joints, and any other areas where the roofing is terminated or interrupted.

FLOATING BRACKET
A bracket which gets installed on the right edge of a TLS array and integrates with asphalt shingles. The right side bracket is used to mount a hook and wire cover. It is also installed on the bottom left corner of an array with jumper modules at bottom.

HOOK
Mounting apparatus that slides into the base plate of the ES or right side bracket that is used to connect the wire channel.

JUMPER MODULE
A non-power producing TLS ES with a J-box on either side, typically used to transfer wiring from one column of ES to the next to allow for series connections.

MOUNTING PLANE (MP)
A contiguous roofing plane of a single azimuth and pitch that has TLS ESs installed on it; they are assigned numbers to differentiate between different mounting planes on a home (MP1, MP2 etc.)

OFFSET
Distance between roofing shingle buttjoints

QUICKSTART
GAF roll starter used in asphalt roofing.

STARTER
A shingle used for water shedding and is installed around the perimeter of the roof under asphalt shingles.

STEP FLAP
A sheet of TPO (10" x 15 1/8") placed underneath the butt joints between the asphalt and ESs, as well as all jumper module joints, to aid in water shedding.

SHINGLE
A roof covering typically made of asphalt consisting of individual overlapping elements. These elements are typically flat, rectangular shapes laid in courses from the bottom edge of the roof up, with each successive course overlapping the joints below.

SHINGLE BOOK
A proficient method of installing shingles to ensure that all the exposed shingle buttjoints will be stair stepped uniformly up the roof.

SHINGLE EXPOSURE
The portion of the shingle left uncovered by the one above it.

SHINGLE REVEAL
The distance of the shingle left uncovered by the one above it.

TOP FLASHING
Flashing that gets installed at the top of every TLS wire channel.

TOP FLASHING LID
A cover that hooks onto the wire cover and mounts to the top flashing base.

UNDERLAYMENT
What lies between the shingles and the roof sheathing

WIRE CHANNEL
A channel on the left side of every column of Energy Shingles where outdoor rated wires and connectors are plugged together and managed. An additional wire channel is also installed on the right side of each array to aid in wire management and aesthetics.

WIRE COVER
A cover that gets installed over every wire channel to shield electrical components from UV and shed water away.

APPROVED ASPHALT SHINGLES AND SEALANTS

COMPONENT	MANUFACTURER	PROVIDED BY
Timberline Solar HDZ™	GAF	Installer
Timberline HDZ®	GAF	Installer
Timberline UHDZ®	GAF	Installer
Timberline® ASII	GAF	Installer
Timberline® NS	GAF	Installer
Timberline HDZ® RS	GAF	Installer
Loctite® PL Max	Loctite®	Installer

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