

Energy Instructor

Steve Geiger

Mounting & Rail Systems

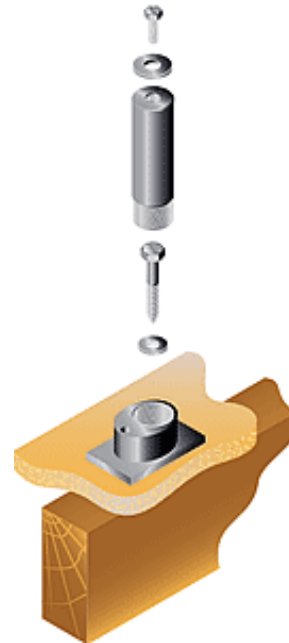
For PV Module Installation

Mounts

Roof Mount / Standoff Brands:



QuickMount PV



Pro Solar



**Thompson
Technology**

Mounting Systems

- Pole Mounts
 - Static
 - Adjustable
 - With Tracker (Single or Dual Axis)
- Ground Mounts
- Roof Mounts
 - Flush Systems (Fixed)
 - Tilt Up (or Adjustable)

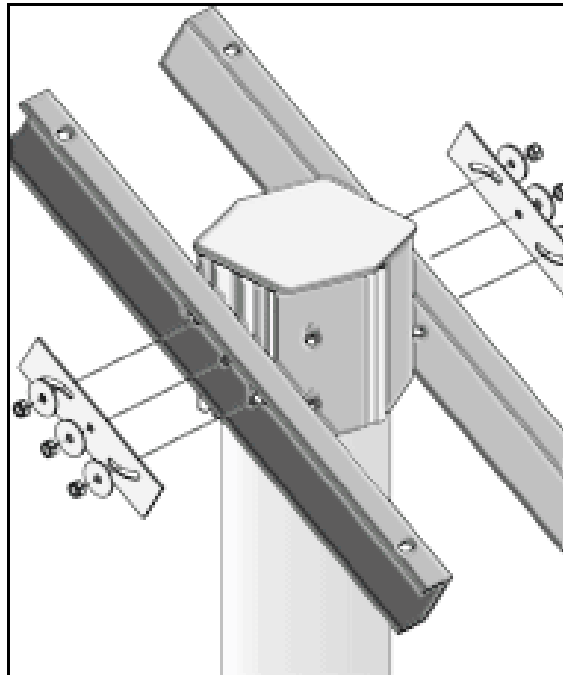
(Standoff height - CA Building Code - No higher than 6")

Pole Mounts - Static

Strong, Lightweight, Easy to Assemble



Series 5004 Poletop



Wind pressure ratings

Each PV PoleTops Installation is rated as a **full system** based on rack model, type and number of PV modules, array tilt angle, and mounting pole characteristics.

Pole Mounts with Tracker



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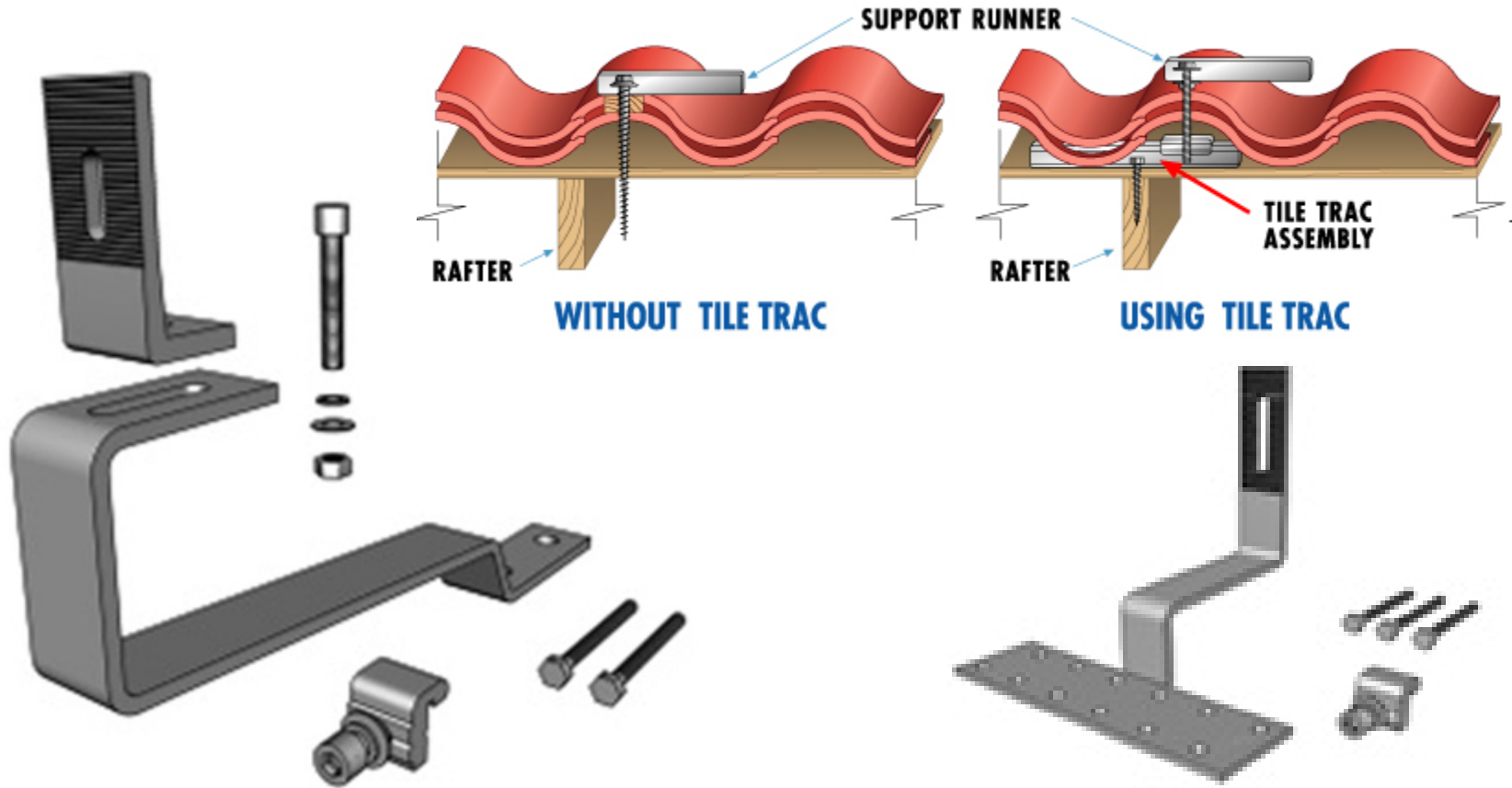
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Ground Mounts



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Roof Tile Mounts



Flat Tile Hook

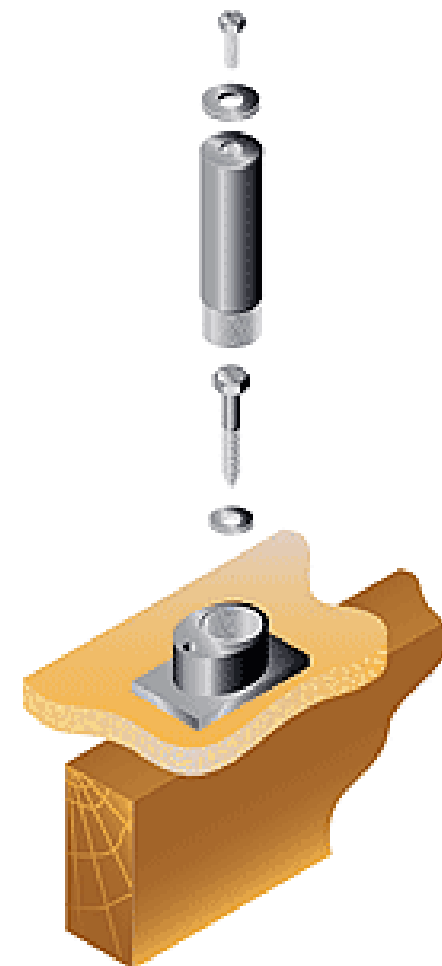
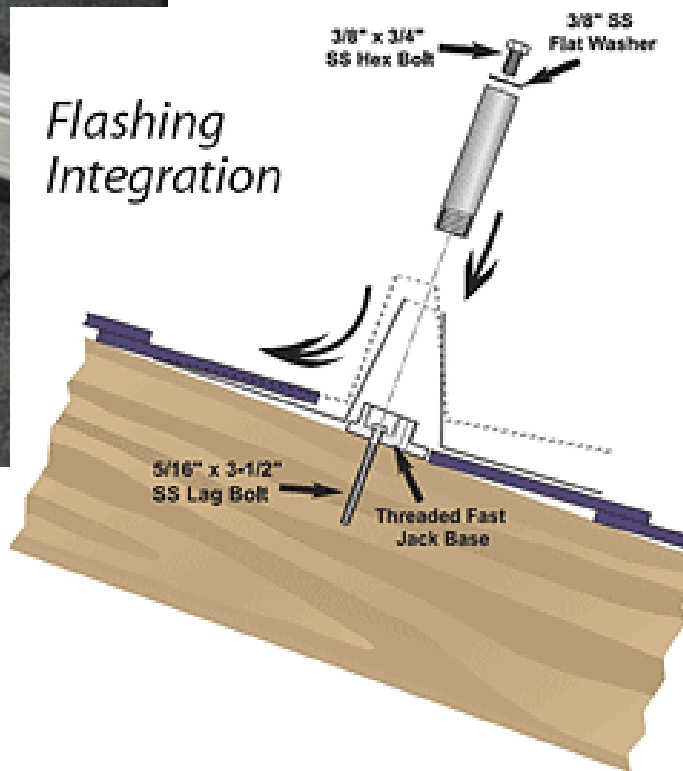
Roman Tile Hook

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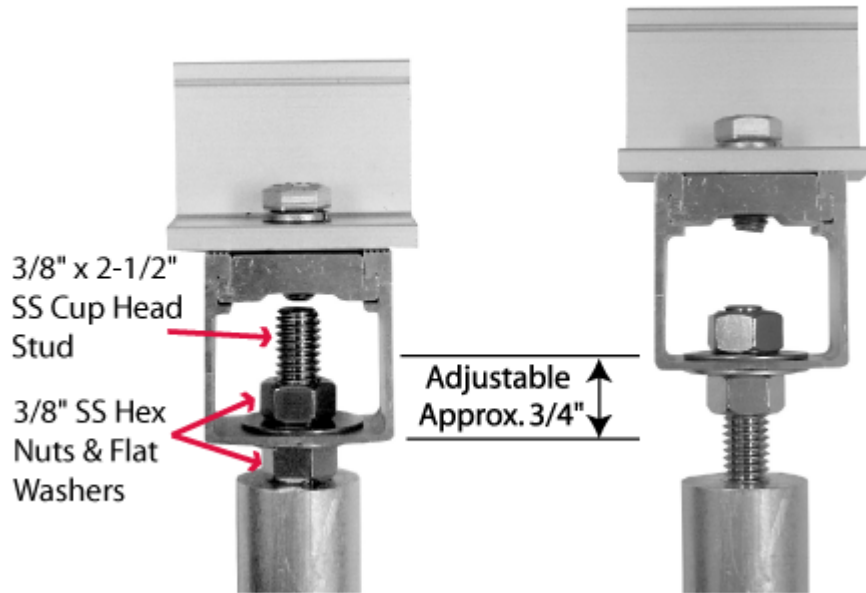
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Flat Roof Mounts



Mount Adjustment



Shims

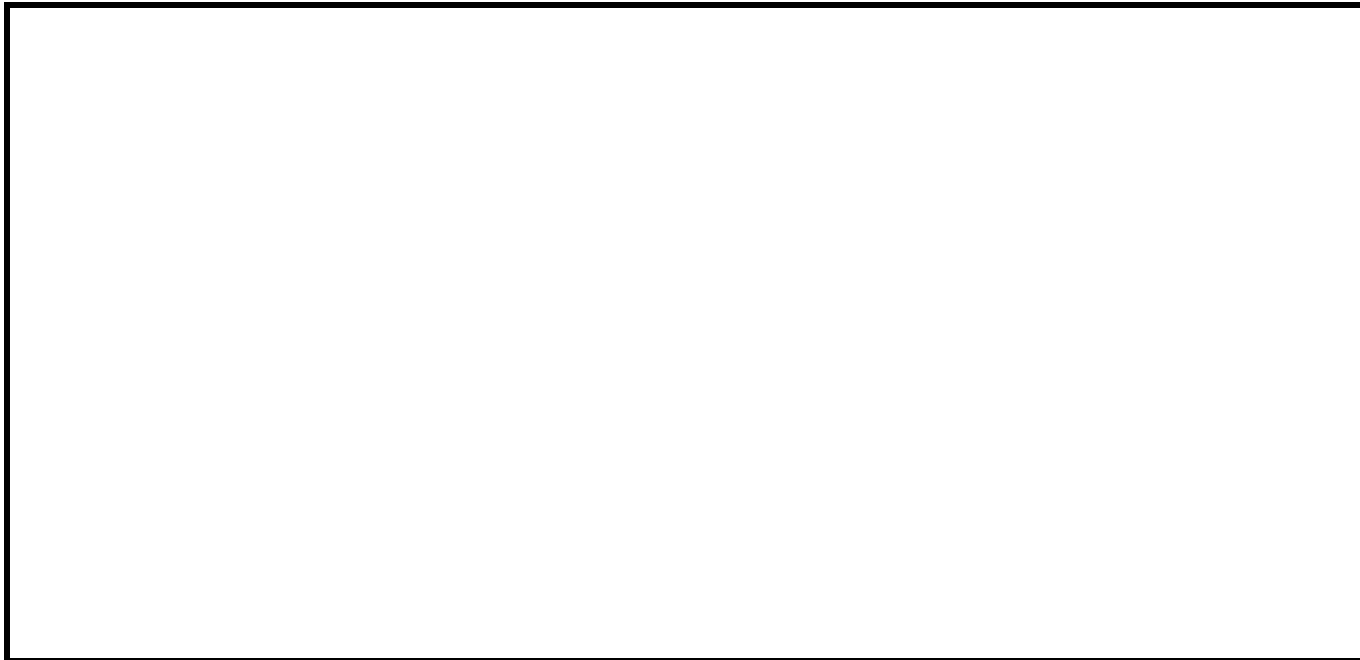


Layout Calculations – The First Step

- Find module size
- Find array row size
- Add rail overhang + mid clamps + array row size = total row size on roof
- Find array column size
- Add spaces (or brackets) = total column size on roof

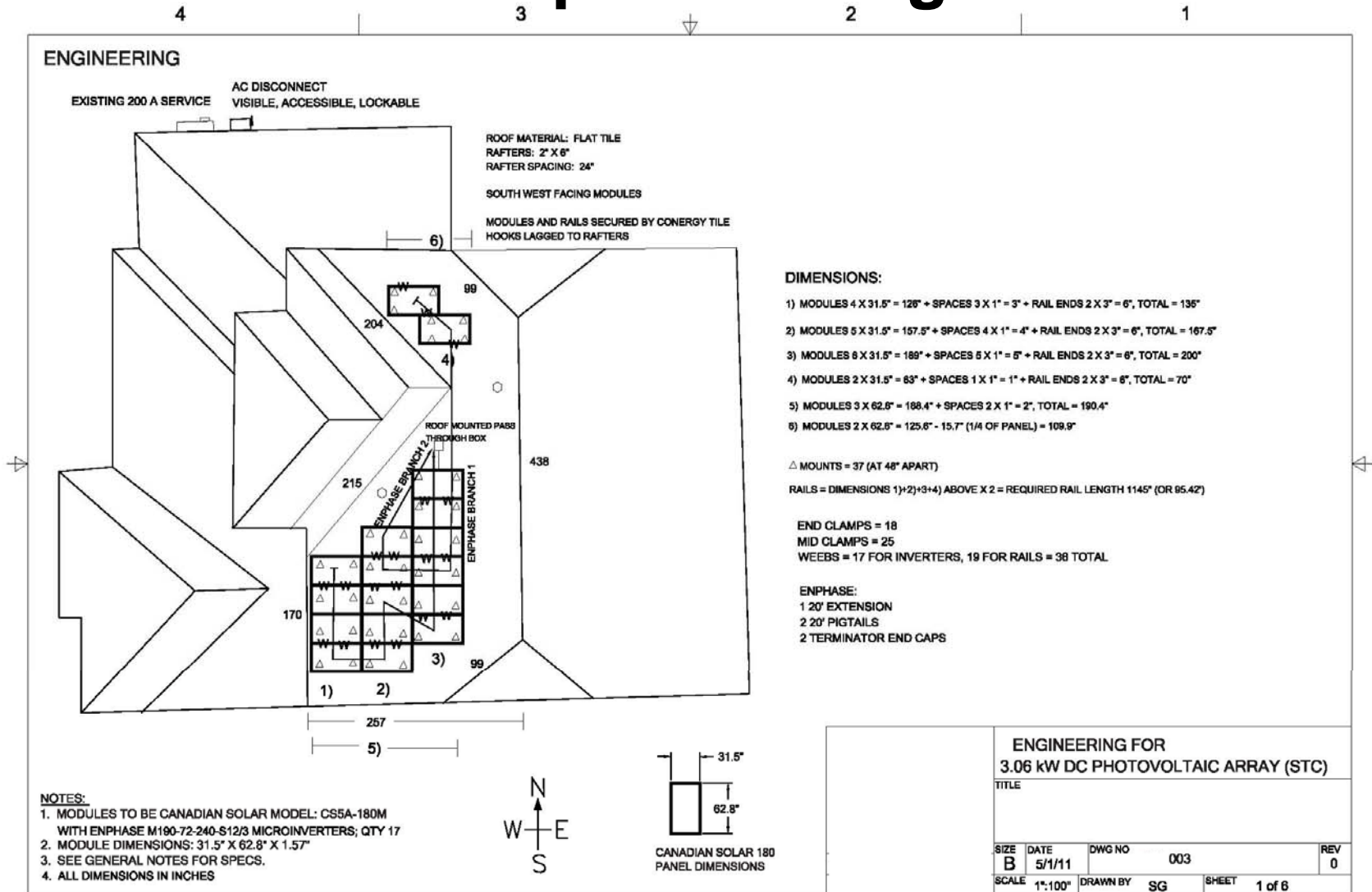
How Many Modules Can You Fit on the Roof?

20 ft. X 16 ft.



Show Math!

Sample Drawing



Layout – On Roof

- Find/Mark rafters on roof (typically 24 to 48 inches) – look at eaves/gutter straps, may need to look in attic
- Mark panel/array location
- Mark rail locations (1/4 of panel for top and bottom rails) on roof
- Mark mount locations on roof

Take inventory for correct hardware before starting the install!

How to find the Rafters and prep for Standoffs

- Find/Mark rafters on roof (typically 24 to 48 inches) – look at eaves/gutter straps, may need to look in attic
- Remove tiles if necessary
- Use a deep sensing stud finder (mixed results)
- Tap with a hammer, to listen for the rafter
- Drive a galvanized nail – 2.5 to 3” long, to feel for the rafter
- Pre-drill the hole with the appropriate bit size for the lag bolt



Roof Mount Installation Process

- 1. Review Plans.** Look at the site elevation and single line drawings and check for errors.
- 2. Calculate.** Calculate and/or recheck the math on the site elevation drawing for module row and column width, height, mid and end clamp spacing, rail length and overhang, rail placement, number of standoffs, etc. Have a team member check these figures.
- 3. Chalk.** Go up on the roof and chalk out the array area using your calculations from above. Use a chalk line if needed. Mark where you can see the rafters under the eaves. Mark each rail placement – and pick the best spot, whether roof is comp or tile, for the mounts.
- 4. Mounts.** Begin placing the mounts. Space according to job specifications (typically 4 to 8 feet apart). Find rafter by tapping with hammer, then pound a galvanized nail to check, drill pilot hole, fill with roofers caulk, then drive in lag bolt, and add extra roofers caulk to any stray holes or around the mount, then flash and caulk (if applicable).

Mount Spacing

SnapNrack™ PV ROOF MOUNT INSTALLATION MANUAL

- Mounts are spaced according to the mount and rail manufacturer's load specifications.
- Typically between every 4 to 8 feet.

MAXIMUM RAIL SPANS BETWEEN STANDOFFS (FT.) (Topographic Effects)

Conditions	Windspeed (Nominal 3-sec. Gust in mph)				
	90	105	120	135	150
0 to 15 Degree Pitch Building Ht. up to 30 ft. Top Of Hill	8	6	6	4	4
0 to 15 Degree Pitch Building Ht. up to 30 ft. Coastal Condition	6	6	4	4	2
0 to 15 Degree Pitch Building Ht. up to 30 ft. Mesa Condition	6	6	4	4	2
16 to 30 Degree Pitch Building Ht. up to 30 ft. Top Of Hill	6	6	4	4	2
16 to 30 Degree Pitch Building Ht. up to 30 ft. Coastal Condition	6	4	4	2	2
16 to 30 Degree Pitch Building Ht. up to 30 ft. Mesa Condition	6	4	4	2	2
31 to 45 Degree Pitch Building Ht. up to 30 ft. Top Of Hill	6	4	4	2	2
31 to 45 Degree Pitch Building Ht. up to 30 ft. Coastal Condition	6	4	2	2	2
31 to 45 Degree Pitch Building Ht. up to 30 ft. Mesa Condition	6	4	2	2	2
46 to 60 Degree Pitch Building Ht. up to 30 ft. Top Of Hill	6	6	4	4	2
46 to 60 Degree Pitch Building Ht. up to 30 ft. Coastal Condition	6	4	4	2	2
46 to 60 Degree Pitch Building Ht. up to 30 ft. Mesa Condition	6	4	4	2	2

*No Snow Load Taken Into Account With Topographic Effects. If Site Has Snow Loads AND Topographic Effects, Please Contact Taylor & Syfan.

Residential Roof Materials

- Shake Shingle
- Composite Shingle
(10-50 yr.)
- Tile (Concrete):
 - S
 - W
 - Flat
 - Clay Spanish
- Metal

Other (Res or Comm)

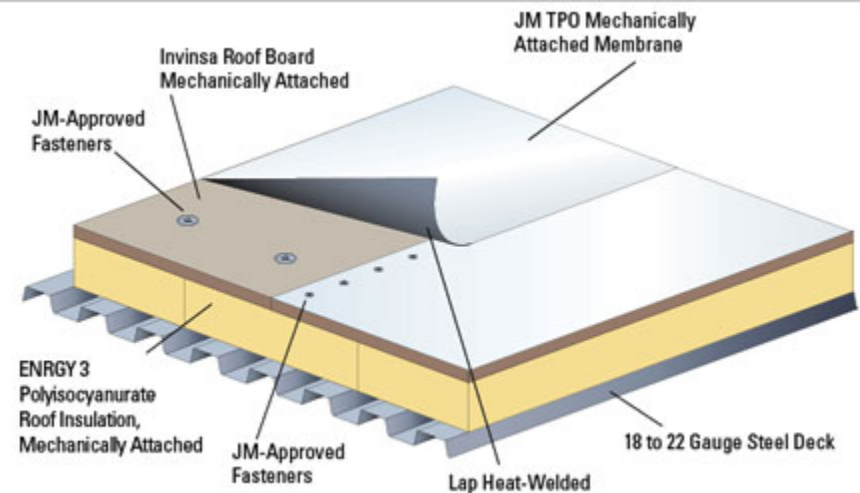
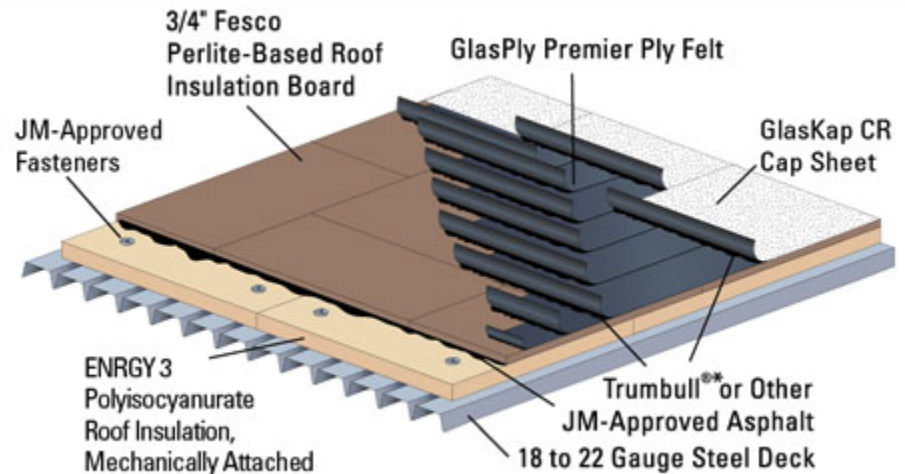
- Standing Seam Metal
- Corrugated Metal

Commercial Roof Materials

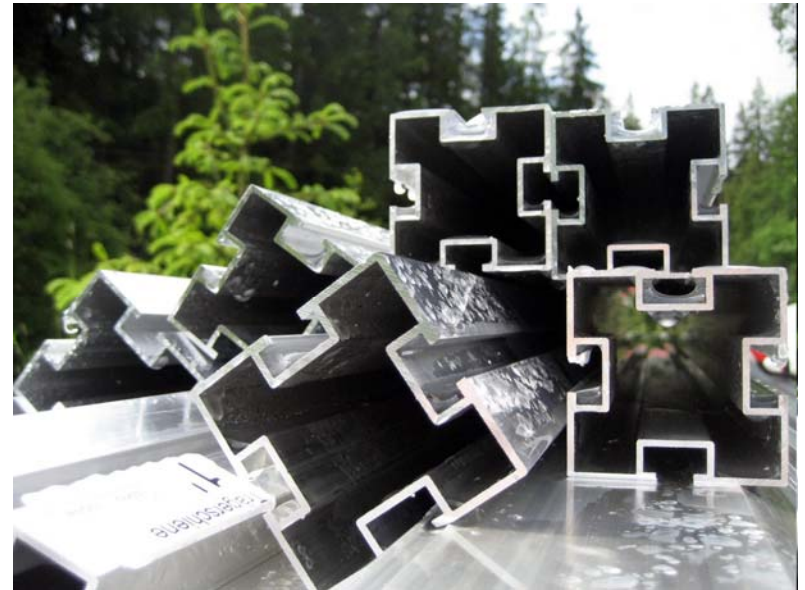
- Bituminous Roofing: BUR – Built Up (Tar and Rolled Composite)

- Single Ply Roofing: TPO, PVC, EPDM

(Johns Manville)

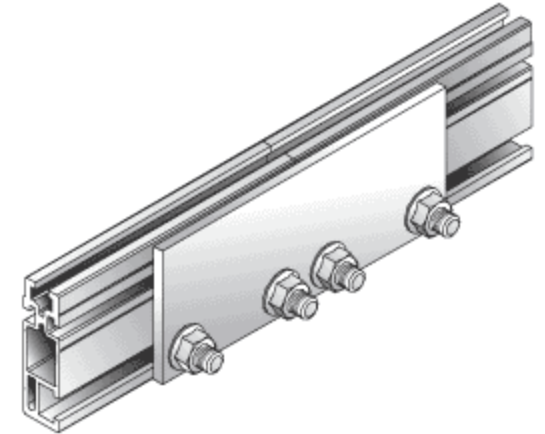
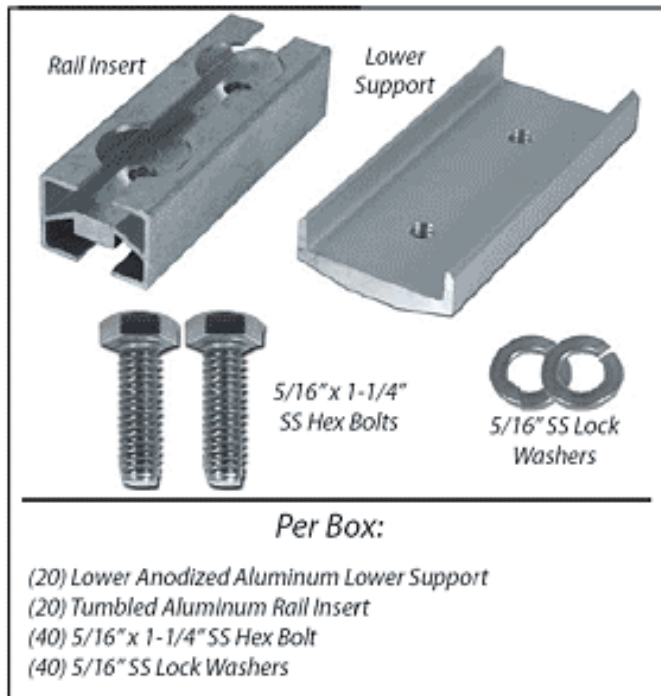


Rails

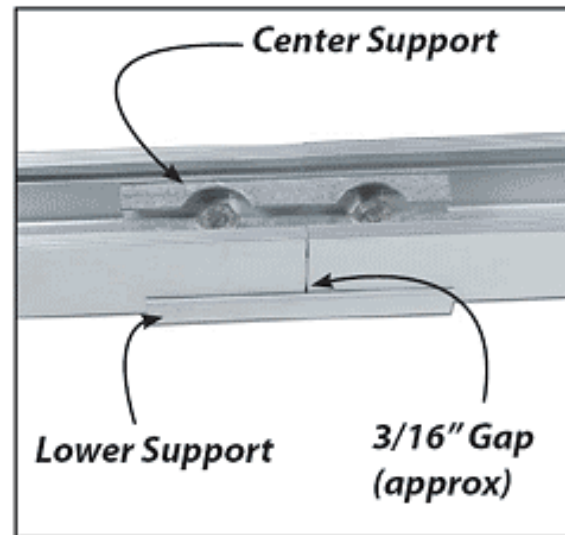


Rail Splices

INCLUDED PARTS



INSTALLED SPLICE

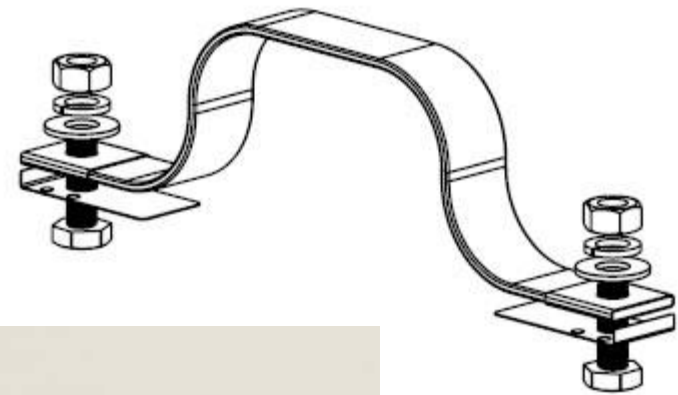


Remember to leave an 1/8 to 3/16" gap for thermal expansion!

Grounding

Grounding Straps/Bonding Jumpers

When splicing rails they must be grounded together!



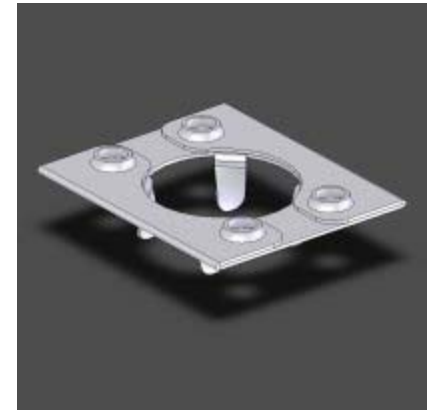
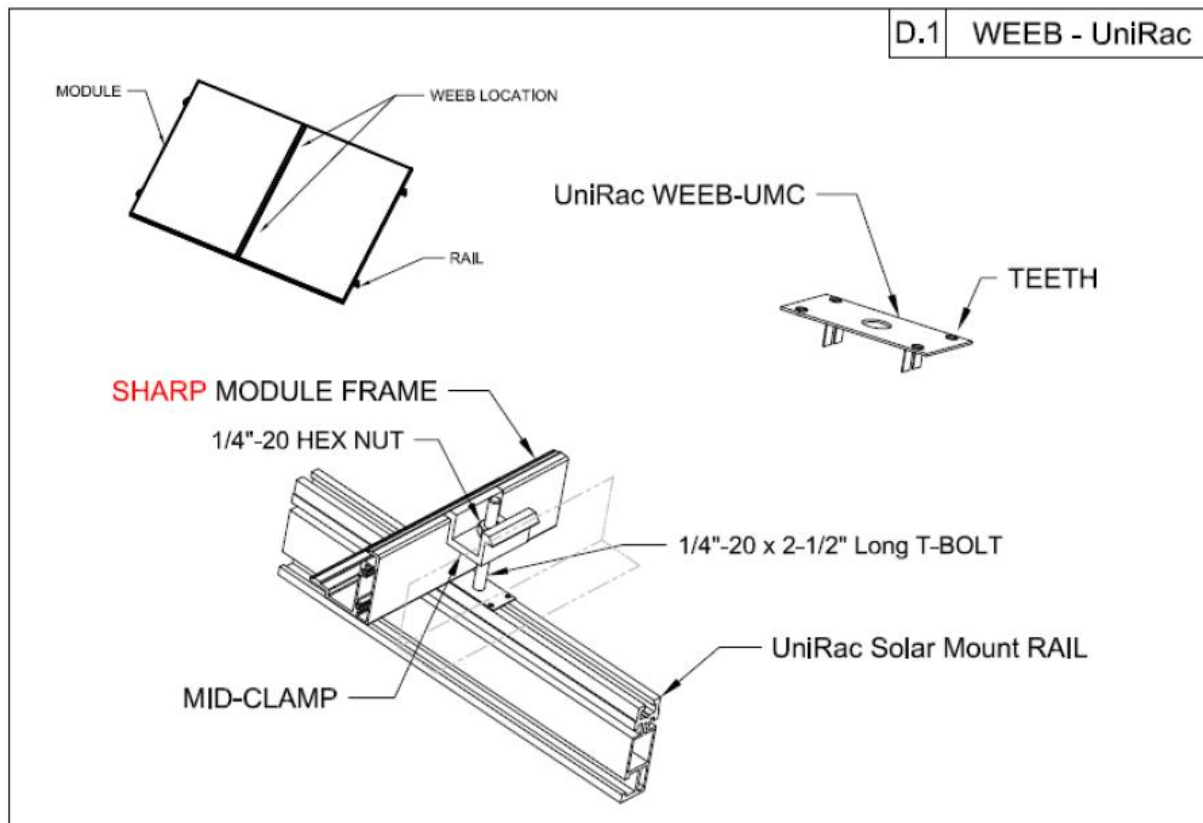
Part of
Equipment
Grounding



Grounding
Lay-in Lugs

WEEBs (Washer, Electrical Equipment Bond)

Used to ground modules, inverters or lugs to rails.



Clamps



Solar Rail Installation Process

- 1. Rails.** Cut rails to correct length, and use splices if necessary. Bring rails up to roof and line up ends using large square, then attach to mounts loosely (marking and drilling holes may be necessary). Use a chalk line to level the rails between one another, and insert shims in between rail and mount if necessary. This helps to eliminate waves in the array. Then tighten all rail bolts. **Always start at the bottom and work up when Installing Rails, and Modules Too!**
- 2. Clamps.** Prepare and insert correct number of mid-clamps and end-clamps in the rails if applicable (also put in WEEBs on every other clamp for each rail [so that each panel gets grounded to each rail] if required).
- 3. Ground the Rails.** Use #8 AWG solid copper with lay in lugs to ground the rails to one another. Every rail needs to be grounded on both sides of a splice (may use grounding jumpers).

Now we are ready to install modules!

Installing the Modules

- 1. Measure.** When installing the modules we want them to look straight to the roofline, etc. Measure from the edges of the rails or roof. Take time to position the first module. Visually look for straightness. **Your first module will dictate the straightness of the entire array!**
- 2. Check the measurements again.** After installing the second and third modules, check the measurements again. Visually look for straightness. Loosen the clamps and reposition the modules if necessary. Be careful to position the WEEBS carefully, and not to bend them, when installing the modules.
- 3. Use tools.** Use a speed square to line up the modules next to each other. Use a chalk line, laser level, tape measure or a “good eye” to check for straightness as you go!
- 4. Hide your wires.** Use wire clips or UV rated zip ties to hide your wires from view under the panels, as you move through the module installation. Keep your installation clean!

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Shim to avoid waves in rails!

Warranties

- Roof warranty is void once solar installer makes penetrations.
- Solar installer takes on the roof warranty.
- Extra care must be taken to be sure the roof will not leak!
- Possibility of self ballasted racking system (on flat roofs).

Documenting the Job

- It is important to physically and digitally document each job that you do for reference if necessary.
 1. Take Pictures During Install.
 - This should include the following: Mounts; rails; array wiring; wiring inside each box, inverter, etc.; and wiring inside service panels; as well as final pictures of the array and system for a portfolio.
 2. Keep records of all products used and purchased – receipts, invoices, etc.
 3. Keep a copy of everything given to the customer in the Commissioning Binder.
 4. Place all above items in a physical folder or binder, as well as a digital folder on the computer.

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Thank You

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