MONTGOMERY COUNTY HISTORIC PRESERVATION COMMISSION
STAFF REPORT

Address:	7221 Spruce Avenue, Takoma Park	**Meeting Date:**	9/3/2025
Resource:	Contributing Resource **Takoma Park Historic District**	**Report Date:**	8/27/2025
		Public Notice:	8/20/2025
Applicant:	Jennifer Airoldi Tina Crouse (Agent)	**Tax Credit:**	No
Review:	HAWP	**Staff:**	Devon Murtha
Permit Number:	1126843		
PROPOSAL:	Solar panel installation		

STAFF RECOMMENDATION

Staff recommends that the HPC **approve with one (1) condition** the Historic Area Work Permit (HAWP) application, with approval of final details delegated to staff:

1. Approval of this HAWP does not extend to the three (3) panels proposed on the west (street-side) main roof the house denoted on *Figure 6* of the staff report. Plans that reflect the approved panels must be submitted to Staff for review and approval prior to issuing the final approval documents.

ARCHITECTURAL DESCRIPTION

SIGNIFICANCE: Contributing Resource within the Takoma Park Historic District
STYLE: Craftsman
DATE: c. 1925-1935

Figure 1: Aerial view of 7221 Spruce Avenue within the Takoma Park Historic District.

PROPOSAL

The subject property is a two-story Craftsman-style house that is a Contributing Resource within the Takoma Park Historic District. The first story features a side-gabled roof, augmented by a partial non-historic second story addition (*Figure 2*).

Figure 2: Subject property from the right-of-way along Spruce Avenue (left) and aerial showing the roof form (right).

The applicant proposes to install fifteen (15) solar panels in five (5) arrays at the subject property. The Q-TRON BLK M-G2+ series panels will be mounted to the asphalt shingle roof with SnapRack mounts. The load center and disconnect switch are proposed towards the southeast/right side elevation.

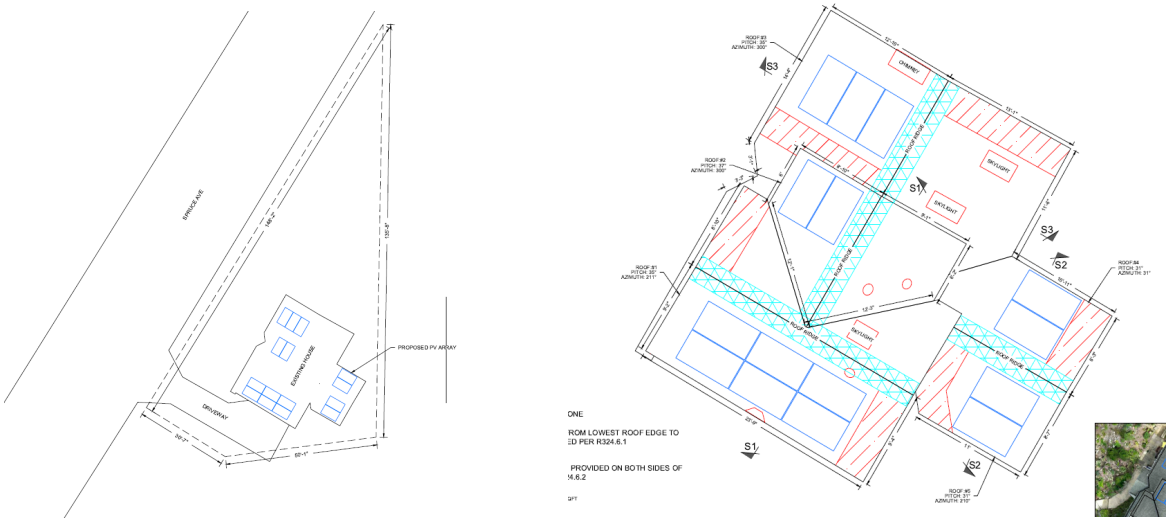
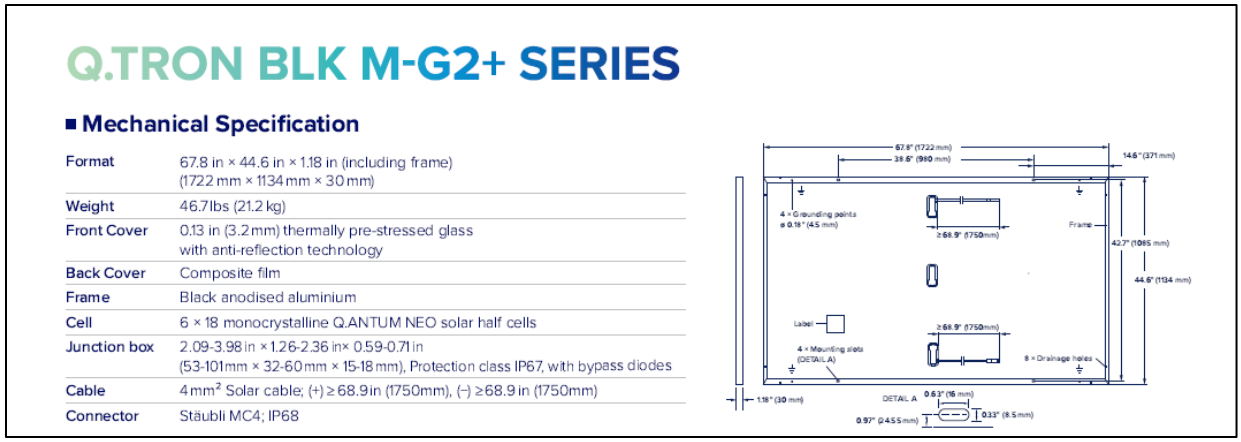


Figure 3: The site plan (left) shows the proposed solar panel locations and the building's relationship to the public right-of-way along Spruce Avenue. The roof plan (right) shows the proposed location of the solar panels and the equipment location.

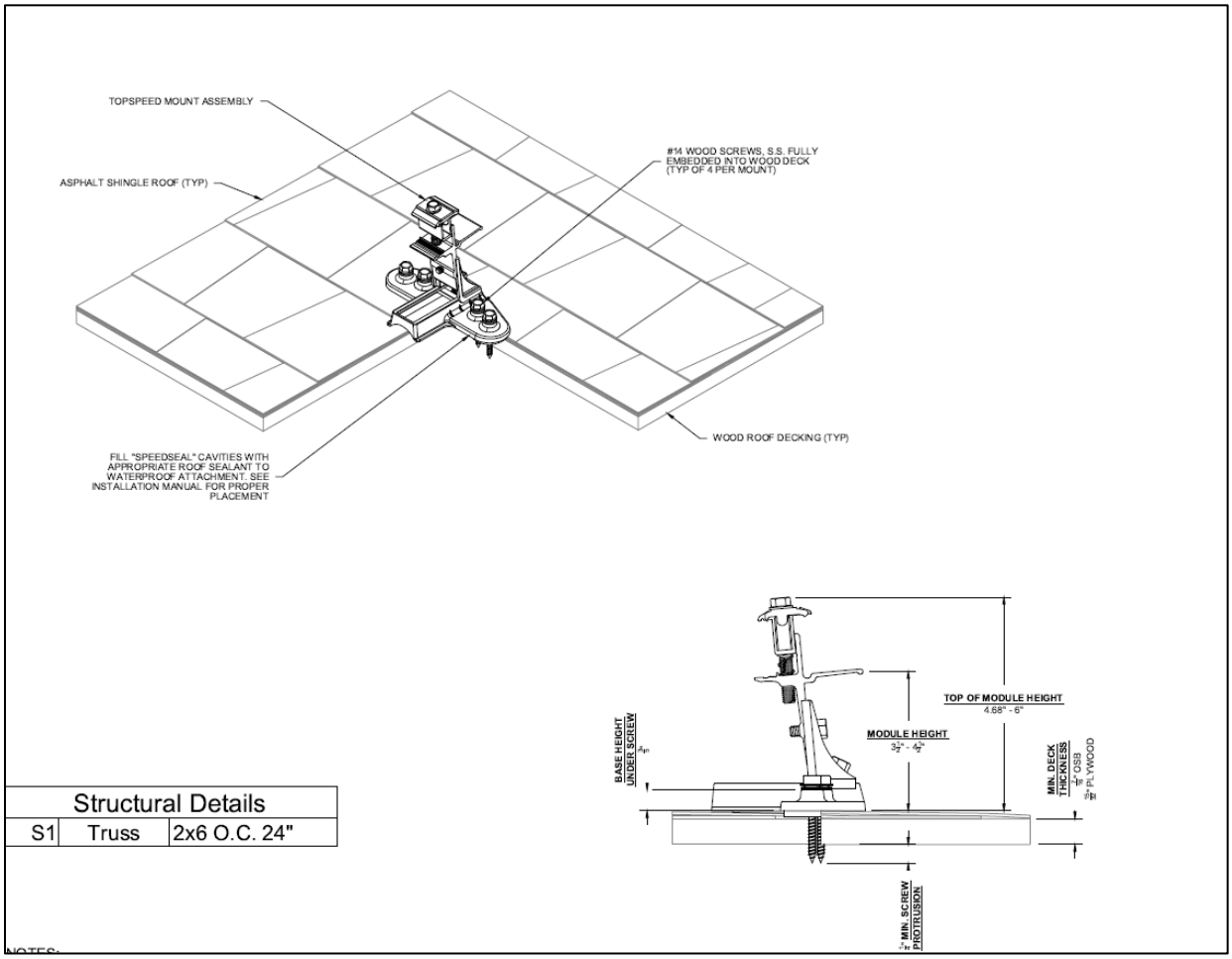


Q.TRON BLK M-G2+ SERIES

■ Mechanical Specification

Format	67.8 in × 44.6 in × 1.18 in (including frame) (1722 mm × 1134 mm × 30 mm)
Weight	46.7 lbs (21.2 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodised aluminium
Cell	6 × 18 monocrystalline Q.ANTUM NEO solar half cells
Junction box	2.09-3.98 in × 1.26-2.36 in× 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), Protection class IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥ 68.9 in (1750 mm), (−) ≥ 68.9 in (1750 mm)
Connector	Stäubli MC4; IP68

Figure 4: Specifications for the solar panels.



Structural Details		
S1	Truss	2x6 O.C. 24"

Figure 5: Installation details for the SnapRack mounts.

APPLICABLE GUIDELINES

The Historic Preservation Office and Historic Preservation Commission (HPC) consult several documents when reviewing alterations and new construction within the Takoma Park Historic District. These documents include the historic preservation review guidelines in the approved and adopted amendment for the *Takoma Park Historic District (Guidelines)*, *Montgomery County Code Chapter 24A (Chapter 24A)*, and *the Secretary of the Interior's Standards for Rehabilitation (Standards),* and the HPC's *Policy No. 20-01: Addressing Emergency Climate Mobilization Through The Installation of Roof-Mounted Solar Panels,*

The pertinent information in these four documents is outlined below.

Takoma Park Historic District Guidelines

There are two broad planning and design concepts which apply to all categories. These are:

- The design review emphasis will be restricted to changes that are all visible from the public right-of-way, irrespective of landscaping or vegetation (it is expected that the majority of new additions will be reviewed for their impact on the overall district), and
- The importance of assuring that additions and other changes to existing structures act to reinforce and continue existing streetscape, landscape, and building patterns rather than to impair the character of the historic district.

Most of the buildings in the Takoma Park Historic District have been assessed as being "Contributing Resources." While these buildings may not have the same level of architectural or historical significance as Outstanding Resources or may have lost some degree of integrity, collectively, they are the basic building blocks of the Takoma Park district. They are important to the overall character of the district and the streetscape due to their size, scale, and architectural qualities, rather than for their particular architectural features.

Contributing Resources should receive a more lenient review than those structures that have been classified as Outstanding. This design review should emphasize the importance of the resource to the overall streetscape and its compatibility with existing patterns rather than focusing on a close scrutiny of architectural detailing. In general, however, changes to Contributing Resources should respect the predominant architectural style of the resource. As stated above, the design review emphasis will be restricted to changes that are at all visible from the public right-of-way, irrespective of landscaping or vegetation.

Some of the factors to be considered in reviewing HAWPs on Contributing Resources include:

- All exterior alterations, including those to architectural features and details, should be generally consistent with the predominant architectural style and period of the resource and should preserve the predominant architectural features of the resource; exact replication of existing details and features is, however, not required.
- Minor alterations to areas that do not directly front on a public right-of-way -such as vents, metal stovepipes, air conditioners, fences, skylights, etc. should be allowed as a matter of course;
- Alterations to areas that do not directly front on a public right-of-way which involve the replacement of or damage to original ornamental or architectural features are discouraged but may be considered and approved on a case-by-case basis.
- Alterations to features that are not visible at all from the public right-of-way should be allowed as a matter of course.
- All changes and additions should respect existing environmental settings, landscaping, and patterns of open space.

Montgomery County Code, Chapter 24A-8

The following guidance which pertains to this project are as follows:

(b) The commission shall instruct the director to issue a permit, or issue a permit subject to such conditions as are found to be necessary to ensure conformity with the purposes and requirements of this chapter, if it finds that:

(1) The proposal will not substantially alter the exterior features of an historic site or historic resource within an historic district; or

(2) The proposal is compatible in character and nature with the historical, archeological, architectural or cultural features of the historic site or the historic district in which an historic resource is located and would not be detrimental thereto or to the achievement of the purposes of this chapter;

(6) In balancing the interests of the public in preserving the historic site or historic resource located within an historic district, with the interests of the public from the use and benefit of the alternative proposal, the general public is better served by granting the permit.

(d) In the case of an application for work on an historic resource located within an historic district, the commission shall be lenient in its judgment of plans for structures of little historical or design significance or for plans involving new construction, unless such plans would seriously impair the historic or architectural value of surrounding historic resources or would impair the character of the historic district. (Ord. No. 9-4, § 1; Ord. No. 11-59.)

Secretary of the Interior's Standards for Rehabilitation

The Secretary of the Interior defines rehabilitation as "the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features, which convey its historical, cultural, or architectural values." The applicable *Standards* are as follows:

2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

Historic Preservation Commission Policy No. 20-01: Addressing Emergency Climate Mobilization Through The Installation of Roof-Mounted Solar Panels

Now, THEREFORE:

WHEREAS, Historic Area Work Permit decisions are guided by the criteria in Section 24A, The Secretary of the Interior's Standards for Rehabilitation, and pertinent guidance from applicable master plan amendments and/or site or district-specific studies;

WHEREAS, The Secretary of the Interior's Standards for Rehabilitation as interpreted by the National Park Service limit the placement of rooftop solar panels under Standards 2, 9, and 10 to less conspicuous locations;

WHEREAS, the County Council has established a Climate Emergency;

WHEREAS, the Historic Preservation is a body established by the County Executive and County Council;

WHEREAS, Section 24-8(b)(6) states, "In balancing the interest of the public in preserving the historic site or historic resource located within an historic district, with the interests of the public from the use and benefit of the alternative proposal, the general public welfare is better served by granting the permit;"

WHEREAS, the widespread use of solar panels, both for hot water and for electricity production, will reduce greenhouse gases in the county, in accordance with the aims of the Emergency Climate Mobilization resolution (Resolution No.: 18-974), it shall be the policy of the Historic Preservation Commission that:

1. The preferred locations for solar panel installation(s) on a designated historic site or an historic resource located within an historic district is a) on the rear of the property, b) on non-historic building additions, c) on accessory structures, or d) in ground-mounted arrays;
2. If it is not feasible to install solar panels in one of the identified preferred locations due to resource orientation or other site limitations; and,
3. The roof is determined to be neither architecturally significant, nor a character-defining feature of the resource, nor is it a slate or tile roof, that unless it can be demonstrated that the solar array will be installed without damaging the historic character of the resource or historic fabric; then
4. The public welfare is better served by approving a Historic Area Work Permit for solar panels on all visible side or front roof slopes under Section 24A-8(b)(6).
5. A Historic Area Work Permit (HAWP) is required for all work referenced in this policy.

STAFF DISCUSSION

The applicant proposes to install fifteen (15) solar panels in five (5) solar panel arrays on the second story addition roof, rear addition roof, and main front roof. Staff generally supports the installation of the proposed solar panels and recommends approval, with the exception of the three solar panels located on the west main front roof. Staff does not support the installation of these three panels and recommends that they be relocated to a rear-facing slope.

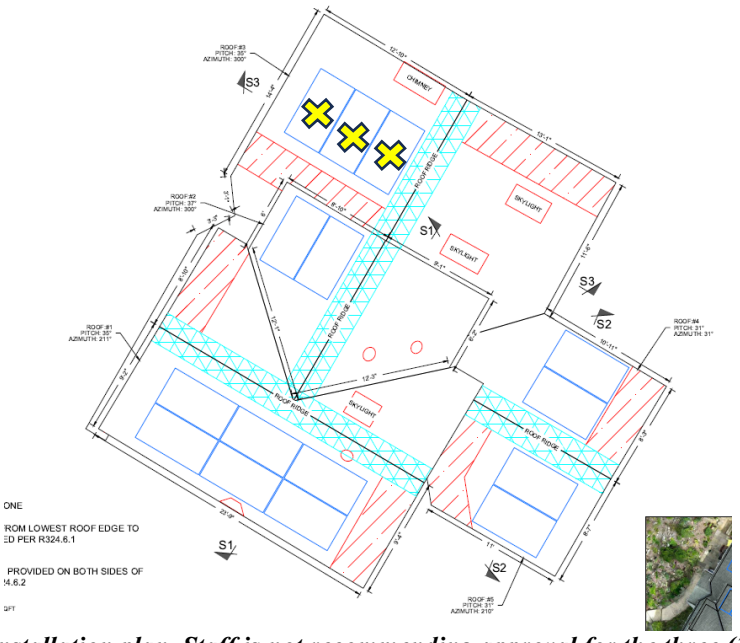


Figure 6: Solar panel installation plan. Staff is not recommending approval for the three (3) panels notated by yellow Xs.

Panels on the Non-Historic Addition

Staff evaluated the proposed placement of the solar panels on the subject property against the guidance provided by *Historic Preservation Commission Policy No. 20-01.* In determining the most appropriate placement of solar panels, the policy guidelines outline several preferred locations, including (in order of preference), in ground-mounted arrays, on accessory structures, on non-historic building additions, and on the rear of the property. Due to the small lot size, substantial tree coverage, and lack of accessory structures, the primary and secondary preferred locations are not feasible placement options for the subject property.

Two of the proposed arrays are located on the second-story roof of the house (*Figure 7*). This roof is on a non-historic building addition, which is a tertiary preferred location as outlined in the *Policy No. 20-01 Guidance*. The 1927 Sanborn maps show that the building was historically a one-story dwelling, and the second story was added later (*Figure 8*).

Figure 7: View of the subject property from the right of way, with the approximate location of the arrays proposed for the second story roof (left) and their location on the plan highlighted in yellow (right).

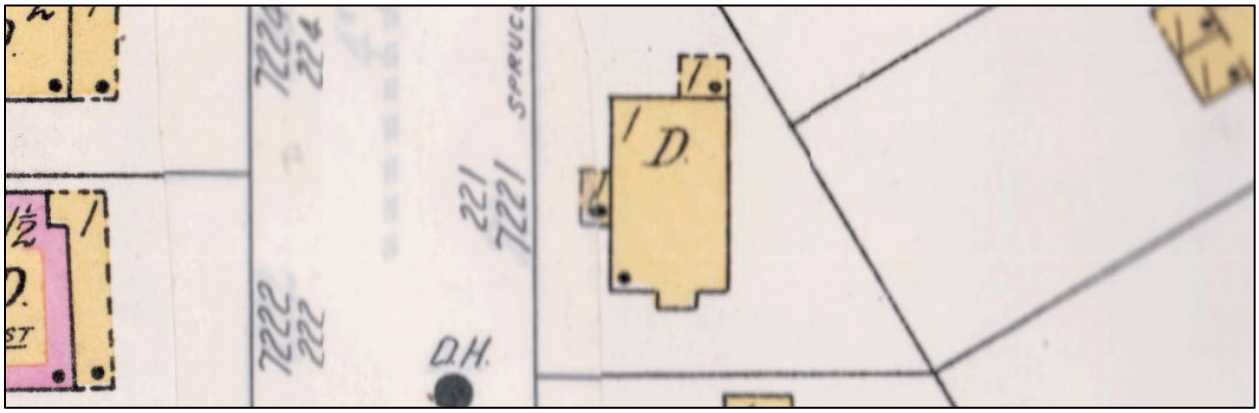


Figure 8: 1927 Sanborn Map showing the subject property as a one-story house.

Staff acknowledges that two arrays will be visible from some vantage points along Spruce Avenue; however, per the *Guidelines*, Staff finds that their installation will not impact the existing pattern of the streetscape. Photovoltaic systems are already an established element of the district and the HPC has approved the installation of solar panels in locations visible from the right-of-way on similar resources. A nearby example is the as the Contributing Resource at 7301 Willow Avenue (*Figure 9*), where the HPC

allowed for the installation of solar panels on the front-facing slope of dormer.[1] The HPC determined that the gentle/lower slope of the dormer roof minimized visibility from the right-of-way, as compared to the main roof slope. The HPC also determined that there were no other feasible locations to install the panels.

Figure 9: View of the 7301 Willow Avenue from the right-of-way.

Two (2) additional proposed arrays of solar panels are located on the rear of the house. These arrays are not visible from the right-of-way at all and are also located on the tertiary preferred location on a non-historic building addition.

Staff finds that the proposed placement of the four (4) solar panel arrays located on the roof of non-historic addition are generally consistent with the *Guidelines* and Chapter 24A. According to the *Guidelines*, the design review for Contributing Resources in Takoma Park should emphasize the importance of the resource to the overall streetscape and its compatibility with existing patterns rather than focusing on a close scrutiny of architectural detailing.

Panels on First Story Front Roof

The applicant is proposing to install one (1) array that consistent of three (3) panels on the west-facing front roof slope of the subject property (*Figure 10*). Staff does not support the installation of this array, finding

[1] The approval documents for 7301 Willow Avenue is located here: https://mcatlas.org/tiles6/06_HistoricPreservation_PhotoArchives/HAWP/HPC%202024-09-04/7301%20Willow%20Avenue,%20Takoma%20Park%20-%201078975%20-%20Approval.pdf.

that it is extremely visible from the right-of-way and will have a substantial impact on the character of the resource.

Figure 10: View of the facade of the building with the proposed location for the front-facing array illustrated as a yellow box (left). The location of the array is highlighted in yellow on the plan (right).

According to *Policy No. 20-01 Guidelines*, if solar panels cannot be installed in preferred locations due to resource orientation and site limitations, and the "roof is determined to be neither architecturally significant, nor a character-defining feature of the resource, nor is it a slate or tile roof," the applicant may install panels on the main historic structure in the interest of public welfare. *Policy No. 20-01 Guidelines* dictates that applicants may install panels on the front-facing slope of roof only when there are no other possible locations for installation, and requires the applicant satisfy a higher burden of persuasion. In cases similar to this, the HPC has required applicants to provide additional details, such as a roof heat map, that show that the solar panels on the front of the house are necessary for the whole solar array to be practically and financially viable.

Staff acknowledges that the unusually shaped, multiplane character of the roof, as well as the presence of numerous skylights and a chimney, creates a particularly challenging condition for solar panel installation on the subject property. However, Staff does not believe that the applicant has demonstrated that there are no other feasible locations for installation. There is additional space on the rear side of the second story addition roof that could likely accommodate additional panels. The applicant has also not provided a heat map or additional justification that would justify the need for this array placement.

Staff recommends the HPC add a condition to this HAWP that the approval does not extend to the street-facing roof slope of the main roof. Additional information could be provided as an amendment to the subject HAWP or could be presented at the HPC meeting to justify the inclusion of some (or all of) the panels on this roof slope.

Staff notes that the HPC placed a similar condition on the approval for HAWP #1069117 for solar panel installation at 7211 Spruce Avenue, a Contributing Resource just a few houses south of the subject property. In that case, the HPC found that the applicant did not provide sufficient justification for the installation of solar panels on the front-facing slope of the contributing resources and included a recommendation excluding ten (10) panels from the approval.

After full and fair consideration of the applicant's submission, staff finds the proposal, as modified by the conditions, consistent with the Criteria for Issuance in Chapter 24A-8(b)(1), (2), and (d), having found the proposal is consistent with the *Secretary of the Interior's Standards for Rehabilitation #2*, *9*, and *10*, and *Takoma Park Historic District Guidelines,* and the *HPC's Policy No. 20-01* as outlined above.

STAFF RECOMMENDATION

Staff recommends that the HPC **approve with one (1) condition** the Historic Area Work Permit (HAWP) application, with approval of final details delegated to staff: .

1. Approval of this HAWP does not extend to the three (3) panels proposed on the west-facing (street-side) main roof the house denoted on Figure 6 of the staff report. Plans that reflect the approved panels must be submitted to Staff for review and approval prior to issuing the final approval documents.

under the Criteria for Issuance in Chapter 24A-8(b)(1) and (2), and Chapter 24A-8(d), having found that the proposal will not substantially alter the exterior features of the historic resource and is compatible in character with the purposes of Chapter 24A;

The Takoma Park Historic District Guidelines;

and with the *Secretary of the Interior's Standards for Rehabilitation # 2, 9,* and *10*;

and with the *Historic Preservation Commission Policy No. 20-01: Addressing Emergency Climate Mobilization Through The Installation of Roof-Mounted Solar Panels;*

and with the general condition that the applicant shall present an electronic set of drawings, if applicable, to HPC staff for review and stamping prior to submission for the Montgomery County Department of Permitting Services (DPS) building permits;

and with the general condition that final project design details, not specifically delineated by the Commission, shall be approved by HPC staff or brought back to the HPC as a revised HAWP application at staff's discretion;

and with the general condition that the applicant shall notify the HPC staff if they propose to make **any alterations** to the approved plans. Once the work is completed the applicant will contact the staff person assigned to this application at 301-495-1328 or devon.murtha@montgomeryplanning.org to schedule a follow-up site visit.

FOR STAFF ONLY:
HAWP# 1126843
DATE ASSIGNED_____

APPLICATION FOR HISTORIC AREA WORK PERMIT

HISTORIC PRESERVATION COMMISSION
301.563.3400

APPLICANT:

Name: Jennifer Airoldi E-mail: jairoldi@gmail.com

Address: 7221 Spruce Avenue City: Takoma Park Zip: 20912

Daytime Phone: 410-992-2021 Tax Account No.: 13-01072438

AGENT/CONTACT (if applicable):

Name: Tina Crouse-Solar Energy World E-mail: tcrouse@solarenergyworld.com

Address: 14880 Sweitzer Lane City: Laurel Zip: 20707

Daytime Phone: 410-570-4157 Contractor Registration No.: 127353

LOCATION OF BUILDING/PREMISE: MIHP # of Historic Property 1126843

Is the Property Located within an Historic District? X Yes/District Name Takoma Park
__No/Individual Site Name_____

Is there an Historic Preservation/Land Trust/Environmental Easement on the Property? If YES, include a map of the easement, and documentation from the Easement Holder supporting this application.

Are other Planning and/or Hearing Examiner Approvals /Reviews Required as part of this Application? (Conditional Use, Variance, Record Plat, etc.?) If YES, include information on these reviews as supplemental information.

Building Number: 7221 Street: Spruce Avenue

Town/City: Takoma Park Nearest Cross Street: Park Avenue

Lot: P15 Block: 7 Subdivision: 0025 Parcel: 0000

TYPE OF WORK PROPOSED: See the checklist on Page 4 to verify that all supporting items for proposed work are submitted with this application. Incomplete Applications will not be accepted for review. Check all that apply:

- ☐ New Construction
- ☐ Addition
- ☐ Demolition
- ☐ Grading/Excavation
- ☐ Deck/Porch
- ☐ Fence
- ☐ Hardscape/Landscape
- ☐ Roof
- ☐ Shed/Garage/Accessory Structure
- ☑ Solar
- ☐ Tree removal/planting
- ☐ Window/Door
- ☐ Other:_____

I hereby certify that I have the authority to make the foregoing application, that the application is correct and accurate and that the construction will comply with plans reviewed and approved by all necessary agencies and hereby acknowledge and accept this to be a condition for the issuance of this permit.

Tina Crouse 07/27/2025

Signature of owner or authorized agent Date

HAWP APPLICATION: MAILING ADDRESSES FOR NOTIFING

[Owner, Owner's Agent, Adjacent and Confronting Property Owners]

Owner's mailing address	**Owner's Agent's** mailing address
Jennifer Airoldi 7221 Spruce Avenue Takoma Park, MD 20912	Tina Crouse-Solar Energy World 14880 Sweitzer Lane Laurel, MD 20707
Adjacent and confronting Property Owners mailing addresses	
Joseph Murphy 7219 Spruce Avenue Takoma Park, MD 20912 (Adjacent Property)	Pooja Parikh 222 Park Avenue Takoma Park, MD 20912 (Adjacent Property)
Curtis Tarnoff 7226 Spruce Avenue Takoma Park, MD 20912 (Confronting Property)	Eric Wills 7224 Spruce Avenue Takoma Park, MD 20912 (Confronting Property)

Description of Property: Please describe the building and surrounding environment. Include information on significant structures, landscape features, or other significant features of the property:

Property Built in 1923

Description of Work Proposed: Please give an overview of the work to be undertaken:

-Install (5) roof mounted solar panels on detached structure

-Micro Inverters to be placed under each panel

-Utility disconnect to be installed next to utility meter along with electrical combiner box for micro inverters

Galvanized steel conduit to run from equipment to Solar Array

Work Item 1: _____

Description of Current Condition:	Proposed Work:

Work Item 2: _____

Description of Current Condition:	Proposed Work:

Work Item 3: _____

Description of Current Condition:	Proposed Work:

HISTORIC AREA WORK PERMIT
CHECKLIST OF
APPLICATION REQUIREMENTS

	Required Attachments						
Proposed Work	I. Written Description	2. Site Plan	3. Plans/ Elevations	4. Material Specifications	5. Photographs	6. Tree Survey	7. Property Owner Addresses
New Construction	*	*	*	*	*	*	*
Additions/ Alterations	*	*	*	*	*	*	*
Demolition	*	*	*		*		*
Deck/Porch	*	*	*	*	*	*	*
Fence/Wall	*	*	*	*	*	*	*
Driveway/ Parking Area	*	*		*	*	*	*
Grading/Excavation/Landscaing	*	*		*	*	*	*
Tree Removal	*	*		*	*	*	*
Siding/ Roof Changes	*	*	*	*	*		*
Window/ Door Changes	*	*	*	*	*		*
Masonry Repair/ Repoint	*	*	*	*	*		*
Signs	*	*	*	*	*		*

Front of Home


Back of Home

Left side of Home

Right side of Home

DAVID C. HERNANDEZ, PE

513-418-8812 4912 Prospect Ave., Blue Ash OH 45242 davehernandezpe@gmail.com

DATE: July 24, 2025

RE: 7221 Spruce Ave, Takoma Park, MD 20912, USA

To Whom It May Concern,

As per your request, Exactus Energy has conducted a site assessment of the building at the above address.

PV solar panels are proposed to be installed on roof areas as shown in the submitted plans. The panels are clamped and attached to the roof decking with a rail-less mounting system. The PV system (PV modules, racking, mounting hardware, etc.) shall be installed according to the manufacturer's approved installation specifications. The Engineer of Record and Exactus Energy claim no responsibility for misuse or improper installation.

It was found that the roof systems satisfactorily meet the applicable standards included in the 2021 IBC/IRC, and ASCE 7-16 as well as the design criteria shown below:

Design Criteria:

Risk Category	= II
Exposure Category	= B
Wind speed	= 115 mph
Ground snow load	= 30 psf
Roof dead load	= 12 psf
Solar system dead load	= 3 psf

Overall, the roof system integrity is adequate to support the PV alteration with no modifications or reinforcements as required

This letter was completed in accordance to recognized design standards, professional engineering experience, and judgement. Prior to installation, the on-site contractor must notify Exactus Energy if there are any discrepancies, or damages to the members, that was not addressed in the plan set.

If you have any further questions, please do not hesitate to contact me.

Acknowledged by:

David C. Hernandez, PE Digitally signed by David C. Hernandez, PE
Date: 2025.07.24 20:02:05 -04:00

aee Green Building Engineer #652

STATE OF MARYLAND
DAVID C. HERNANDEZ
49993
PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 49993, EXP 10/06/2026.
07/24/25

DAVID C. HERNANDEZ, PE

513-418-8812 4912 Prospect Ave., Blue Ash OH 45242 davehernandezpe@gmail.com

SEISMIC CHECK

Breakdown of Loads		
Asphalt Shingles:	7	psf
Insulation:	1.5	psf
Plywood Sheathing:	1.5	psf
Rafters:	1	psf
Misc:	1	psf
Live load:	20	psf

Existing Roof Seismic Weight			
Element	Unit Weight (psf)	Area (Sq.ft)	Weight (lbs)
Roof DL	12	1418.00	17016
Exterior Walls	8	1920.00	15360
Interior Walls	6	1920.00	11520
Existing Seismic Weight @Roof Level, We =			43896

New PV System Seismic Weight			
Element	Unit Weight (psf)	Area (Sq.ft)	Weight (lbs)
Pv System	3	315.00	945.00
Seismic Weight of New PV System, Wpv =			945.00

% Increase in Lateral (Seismic) Weight @Roof Level Due to PV System Addition, %-increase = Wpv / We	2.15%	< 10% - Pass

	COMPANY	PROJECT
WoodWorks® SOFTWARE FOR WOOD DESIGN	July 24, 2025 16:00	Roof 1.wwb

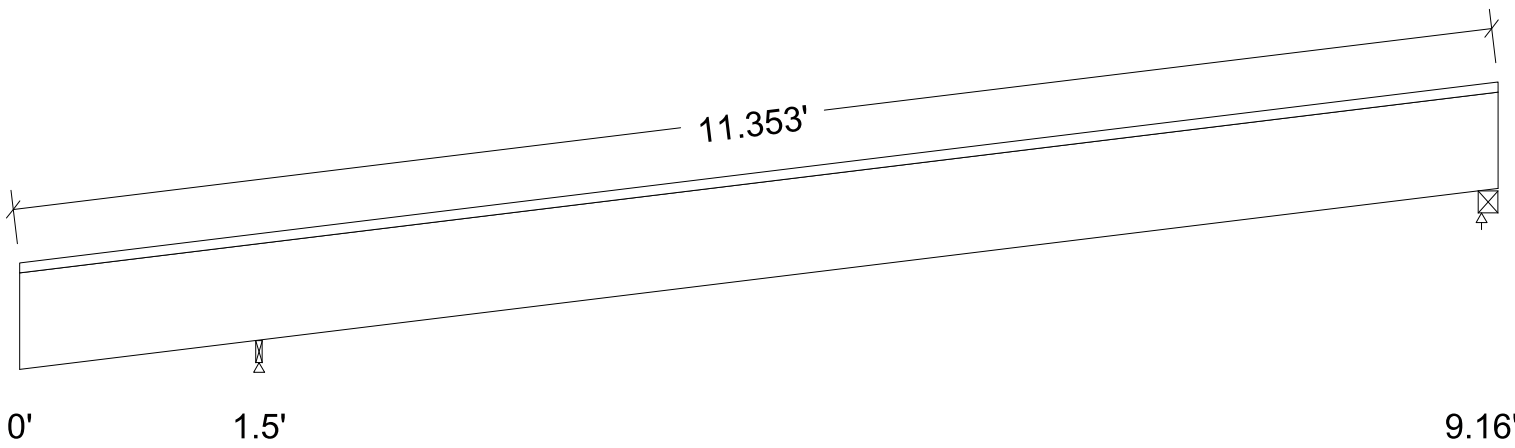
Design Check Calculation Sheet

WoodWorks Sizer 13.2.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
D-ROOF	Dead	Full Area	No			12.00(24.0")		psf
S1	Snow	Partial Area	No	0.00	1.50	23.10(24.0")		psf
L1	Roof live	Partial Area	No	0.00	1.50	20.00(24.0")		psf
S2	Snow	Partial Area	No	7.75	9.26	23.10(24.0")		psf
L2	Roof live	Partial Area	No	7.75	9.26	20.00(24.0")		psf
S3	Snow	Partial Area	No	1.50	7.75	13.40(24.0")		psf
D-PV	Dead	Partial Area	No	1.50	7.75	3.00(24.0")		psf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:					
Dead			187		131
Snow			179		128
Roof Live			69		51
Factored:					
Total			366		259
Bearing:					
F'theta			553		553
Capacity					
Joist			726		1245
Support			398		1195
Des ratio					
Joist			0.50		0.21
Support			0.92		0.22
Load comb			#3		#3
Length			0.50*		1.50
Min req'd			0.50*		0.50*
Cb			1.75		1.00
Cb min			1.75		1.00
Cb support			1.25		1.25
Fcp sup			425		425

*Minimum bearing length setting used: 1/2" for end supports and 1/2" for interior supports

Lumber-soft, S-P-F, No.1/No.2, 2x8 (1-1/2"x7-1/4")

Supports: All - Lumber-soft Beam, S-P-F No.1/No.2

Roof joist spaced at 24.0" c/c; Total length: 11.78'; Clear span(horz): 1.479', 7.618'; Volume = 0.9 cu.ft.; Pitch: 8.5/12

Lateral support: top = continuous, bottom = at supports; Repetitive factor: applied where permitted (refer to online help);

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 25	Fv' = 155	psi	fv/Fv' = 0.16
Bending(+)	fb = 394	Fb' = 1389	psi	fb/Fb' = 0.28
Bending(-)	fb = 78	Fb' = 936	psi	fb/Fb' = 0.08
Deflection:				
Interior Live	0.04 = < L/999	0.47 = L/240	in	0.09
Total	0.13 = L/869	0.63 = L/180	in	0.21
Cantil. Live	-0.02 = < L/999	0.18 = L/120	in	0.12
Total	-0.07 = L/302	0.25 = L/90	in	0.30

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	135	1.15	1.00	1.00	-	-	-	-	1.00	1.00	3
Fb'+	875	1.15	1.00	1.00	1.000	1.200	-	1.15	1.00	1.00	3
Fb'-	875	1.15	1.00	1.00	0.674	1.200	-	1.15	1.00	1.00	3
Fcp'	425	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.4 million		1.00	1.00	-	-	-	-	1.00	1.00	3
Emin'	0.51 million		1.00	1.00	-	-	-	-	1.00	1.00	3

CRITICAL LOAD COMBINATIONS:

```
Shear     : LC #3  = D + S
Bending(+): LC #3  = D + S
Bending(-): LC #3  = D + S
Deflection: LC #3  = D + S  (live)
            LC #3  = D + S  (total)
Bearing   : Support 1 - LC #3 = D + S
            Support 2 - LC #3 = D + S
Load Types: D=dead S=snow Lr=roof live
Load combinations: ASD Basic from ASCE 7-16 2.4; all LC's listed in the Analysis report
```

CALCULATIONS:

```
V max = 209, V design = 182 (NDS 3.4.3.1(a)) lbs
M(+) = 431 lbs-ft; M(-) = 85 lbs-ft
EI = 66.69e06 lb-in^2
"Live" deflection is due to all non-dead loads (live, wind, snow…)
Total deflection = 1.50 permanent + "live"
Bearing: Allowable bearing at an angle F'theta  calculated for each support
as per NDS 3.10.3
Lateral stability(-):  Lu = 9.38'  Le = 15.31'  RB = 24.3; Lu based on full span
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Continuous or Cantilevered Beams: NDS Clause 4.2.5.5 requires that normal grading provisions be extended to the middle 2/3 of 2 span beams and to the full length of cantilevers and other spans.
4. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
5. SLOPED BEAMS: level bearing is required for all sloped beams.
6. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

	COMPANY	PROJECT
WoodWorks® SOFTWARE FOR WOOD DESIGN	July 24, 2025 16:04	Roof 2.wwb

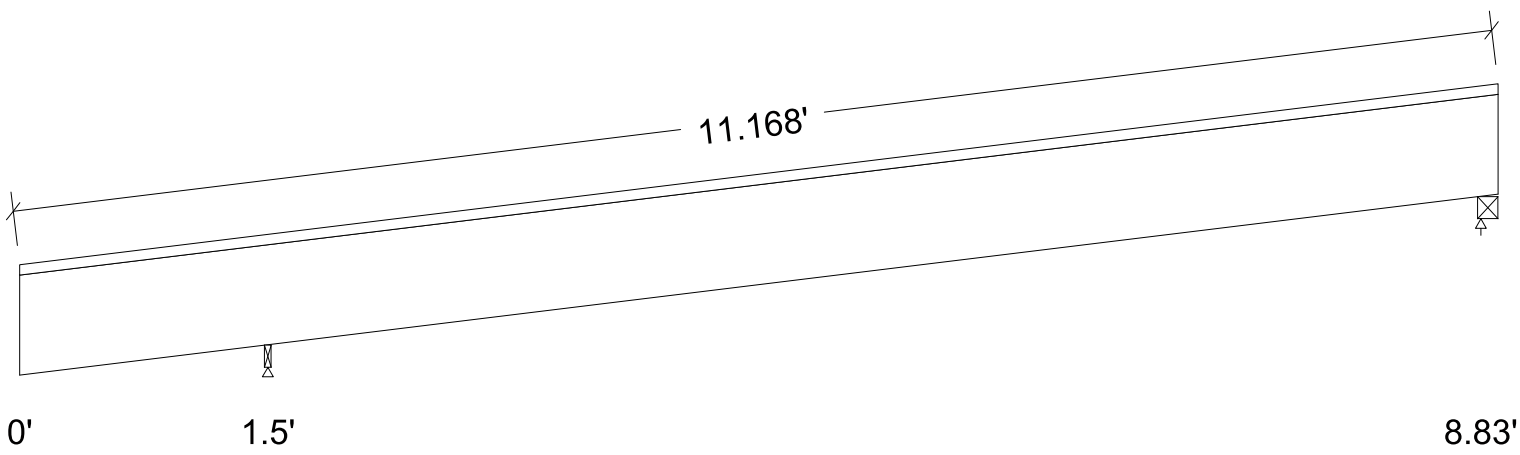
Design Check Calculation Sheet

WoodWorks Sizer 13.2.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
D-ROOF	Dead	Full Area	No			12.00(24.0")		psf
S1	Snow	Partial Area	No	0.00	1.50	23.10(24.0")		psf
L1	Roof live	Partial Area	No	0.00	1.50	20.00(24.0")		psf
S2	Snow	Partial Area	No	7.75	8.83	23.10(24.0")		psf
L2	Roof live	Partial Area	No	7.75	8.83	20.00(24.0")		psf
S3	Snow	Partial Area	No	1.50	7.75	12.71(24.0")		psf
D-PV	Dead	Partial Area	No	1.50	7.75	3.00(24.0")		psf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:					
Dead			185		129
Snow			169		109
Roof Live			67		36
Factored:					
Total			353		239
Bearing:					
F'theta			567		567
Capacity					
Joist			744		1275
Support			398		1195
Des ratio					
Joist			0.48		0.19
Support			0.89		0.20
Load comb			#3		#3
Length			0.50*		1.50
Min req'd			0.50*		0.50*
Cb			1.75		1.00
Cb min			1.75		1.00
Cb support			1.25		1.25
Fcp sup			425		425

*Minimum bearing length setting used: 1/2" for end supports and 1/2" for interior supports

Lumber-soft, S-P-F, No.1/No.2, 2x8 (1-1/2"x7-1/4")

Supports: All - Lumber-soft Beam, S-P-F No.1/No.2

Roof joist spaced at 24.0" c/c; Total length: 11.62'; Clear span(horz): 1.479', 7.288'; Volume = 0.9 cu.ft.; Pitch: 9/12

Lateral support: top = continuous, bottom = at supports; Repetitive factor: applied where permitted (refer to online help);

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 23	Fv' = 155	psi	fv/Fv' = 0.15
Bending(+)	fb = 351	Fb' = 1389	psi	fb/Fb' = 0.25
Bending(-)	fb = 78	Fb' = 951	psi	fb/Fb' = 0.08
Deflection:				
Interior Live	0.03 = < L/999	0.46 = L/240	in	0.07
Total	0.11 = L/989	0.61 = L/180	in	0.18
Cantil. Live	-0.02 = < L/999	0.19 = L/120	in	0.09
Total	-0.06 = L/350	0.25 = L/90	in	0.26

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	135	1.15	1.00	1.00	-	-	-	-	1.00	1.00	3
Fb'+	875	1.15	1.00	1.00	1.000	1.200	-	1.15	1.00	1.00	3
Fb'-	875	1.15	1.00	1.00	0.685	1.200	-	1.15	1.00	1.00	3
Fcp'	425	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.4 million		1.00	1.00	-	-	-	-	1.00	1.00	3
Emin'	0.51 million		1.00	1.00	-	-	-	-	1.00	1.00	3

CRITICAL LOAD COMBINATIONS:

```
Shear     : LC #3  = D + S
Bending(+): LC #3  = D + S
Bending(-): LC #3  = D + S
Deflection: LC #3  = D + S  (live)
            LC #3  = D + S  (total)
Bearing   : Support 1 - LC #3 = D + S
            Support 2 - LC #3 = D + S
Load Types: D=dead S=snow Lr=roof live
Load combinations: ASD Basic from ASCE 7-16 2.4; all LC's listed in the Analysis report
```

CALCULATIONS:

```
V max = 195, V design = 169 (NDS 3.4.3.1(a)) lbs
M(+) = 385 lbs-ft; M(-) = 86 lbs-ft
EI = 66.69e06 lb-in^2
"Live" deflection is due to all non-dead loads (live, wind, snow…)
Total deflection = 1.50 permanent + "live"
Bearing: Allowable bearing at an angle F'theta  calculated for each support
as per NDS 3.10.3
Lateral stability(-):  Lu = 9.19'  Le = 15.00'  RB = 24.1; Lu based on full span
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Continuous or Cantilevered Beams: NDS Clause 4.2.5.5 requires that normal grading provisions be extended to the middle 2/3 of 2 span beams and to the full length of cantilevers and other spans.
4. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
5. SLOPED BEAMS: level bearing is required for all sloped beams.
6. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

	COMPANY	PROJECT
WoodWorks® SOFTWARE FOR WOOD DESIGN	July 24, 2025 16:08	Roof 3.wwb

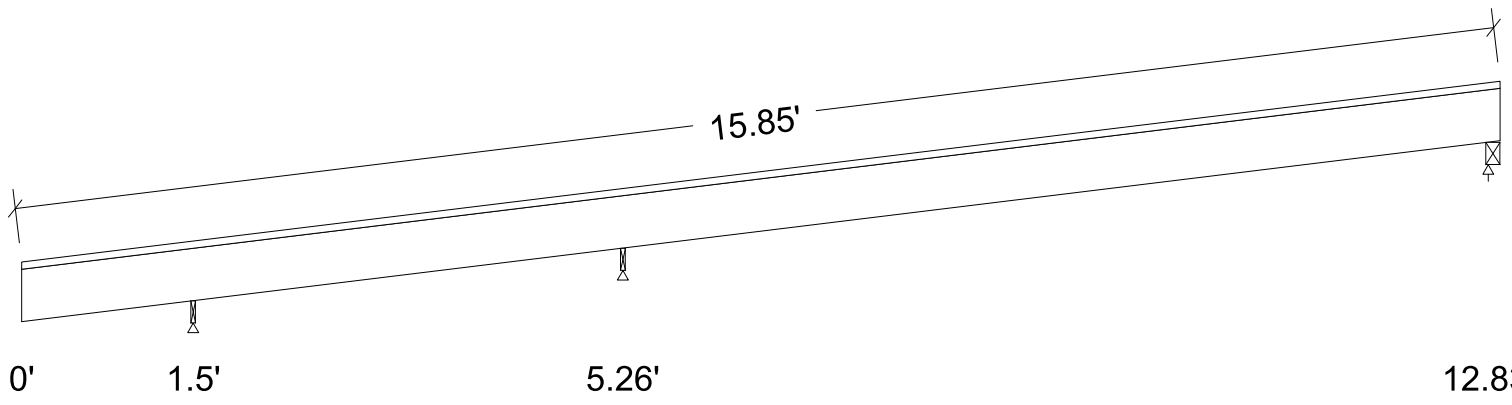
Design Check Calculation Sheet

WoodWorks Sizer 13.2.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
D-ROOF	Dead	Full Area	No			12.00(24.0")		psf
S1	Snow	Partial Area	No	0.00	1.75	23.10(24.0")		psf
L1	Roof live	Partial Area	No	0.00	1.75	20.00(24.0")		psf
S2	Snow	Partial Area	No	11.20	12.93	23.10(24.0")		psf
L2	Roof live	Partial Area	No	11.20	12.93	20.00(24.0")		psf
S3	Snow	Partial Area	No	1.75	11.20	13.40(24.0")		psf
D-PV	Dead	Partial Area	No	1.75	11.20	3.00(24.0")		psf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:								
Dead			84		251			114
Snow			108		184			122
Roof Live			76		2			61
Factored:								
Total			192		435			236
Bearing:								
F'theta			557		557			557
Capacity								
Joist			731		731			1252
Support			398		586			1195
Des ratio								
Joist			0.26		0.60			0.19
Support			0.48		0.74			0.20
Load comb			#3		#3			#3
Length			0.50*		0.50*			1.50
Min req'd			0.50*		0.37**			0.50*
Cb			1.75		1.75			1.00
Cb min			1.75		1.75			1.00
Cb support			1.25		1.25			1.25
Fcp sup			425		625			425

*Minimum bearing length setting used: 1/2" for end supports and 1/2" for interior supports

**Minimum bearing length governed by the required width of the supporting member.

Lumber-soft, S-P-F, No.1/No.2, 2x6 (1-1/2"x5-1/2")

Supports: 1,3 - Lumber-soft Beam, S-P-F No.1/No.2; 2 - Timber-soft Beam, D.Fir-L No.2;
Roof joist spaced at 24.0" c/c; Total length: 16.17'; Clear span(horz): 1.479', 3.718', 7.528'; Volume = 0.9 cu.ft.; Pitch: 8.5/12
Lateral support: top = continuous, bottom = at end supports; Repetitive factor: applied where permitted (refer to online help);

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 39	Fv' = 155	psi	fv/Fv' = 0.25
Bending(+)	fb = 498	Fb' = 1504	psi	fb/Fb' = 0.33
Bending(-)	fb = 528	Fb' = 907	psi	fb/Fb' = 0.58
Deflection:				
Interior Live	0.07 = < L/999	0.46 = L/240	in	0.14
Total	0.18 = L/613	0.62 = L/180	in	0.29
Cantil. Live	0.02 = < L/999	0.18 = L/120	in	0.08
Total	0.03 = L/656	0.25 = L/90	in	0.14

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	135	1.15	1.00	1.00	-	-	-	-	1.00	1.00	3
Fb'+	875	1.15	1.00	1.00	1.000	1.300	-	1.15	1.00	1.00	3
Fb'-	875	1.15	1.00	1.00	0.603	1.300	-	1.15	1.00	1.00	3
Fcp'	425	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.4 million		1.00	1.00	-	-	-	-	1.00	1.00	3
Emin'	0.51 million		1.00	1.00	-	-	-	-	1.00	1.00	3

CRITICAL LOAD COMBINATIONS:

```
Shear     : LC #3  = D + S
Bending(+): LC #3  = D + S
Bending(-): LC #3  = D + S
Deflection: LC #3  = D + S  (live)
            LC #3  = D + S  (total)
Bearing   : Support 1 - LC #3 = D + S
            Support 2 - LC #3 = D + S
            Support 3 - LC #3 = D + S
Load Types: D=dead S=snow Lr=roof live
Load combinations: ASD Basic from ASCE 7-16 2.4; all LC's listed in the Analysis report
```

CALCULATIONS:

```
V max = 234, V design = 214 (NDS 3.4.3.1(a)) lbs
M(+) = 314 lbs-ft; M(-) = 333 lbs-ft
EI = 29.12e06 lb-in^2
"Live" deflection is due to all non-dead loads (live, wind, snow…)
Total deflection = 1.50 permanent + "live"
Bearing: Allowable bearing at an angle F'theta  calculated for each support
as per NDS 3.10.3
Lateral stability(-):  Lu = 13.88'  Le = 21.38'  RB = 25.0; Lu based on full span
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Continuous or Cantilevered Beams: NDS Clause 4.2.5.5 requires that normal grading provisions be extended to the middle 2/3 of 2 span beams and to the full length of cantilevers and other spans.
4. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
5. SLOPED BEAMS: level bearing is required for all sloped beams.
6. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

	COMPANY	PROJECT
WoodWorks® SOFTWARE FOR WOOD DESIGN	July 24, 2025 16:02	Roof 4 & Roof 5.wwb

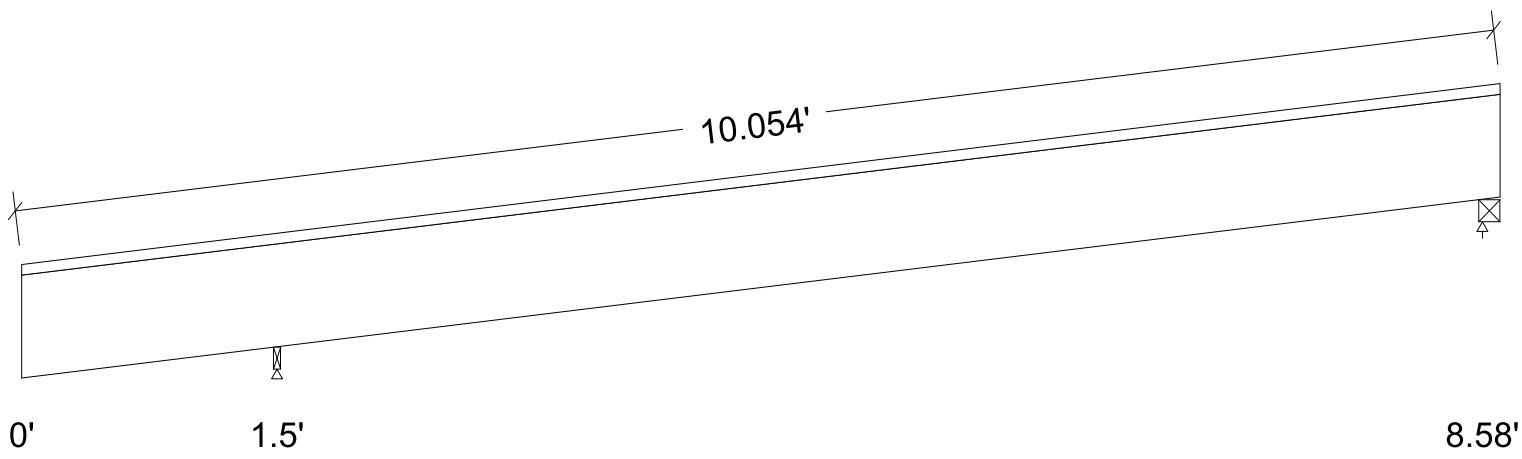
Design Check Calculation Sheet

WoodWorks Sizer 13.2.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
D-ROOF	Dead	Full Area	No			12.00(16.0")		psf
S1	Snow	Partial Area	No	0.00	1.50	23.10(16.0")		psf
L1	Roof live	Partial Area	No	0.00	1.50	20.00(16.0")		psf
S2	Snow	Partial Area	No	7.75	8.68	23.10(16.0")		psf
L2	Roof live	Partial Area	No	7.75	8.68	20.00(16.0")		psf
S3	Snow	Partial Area	No	1.50	7.75	15.02(16.0")		psf
D-PV	Dead	Partial Area	No	1.50	7.75	3.00(16.0")		psf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:					
Dead			112		78
Snow			121		79
Roof Live			44		20
Factored:					
Total			233		157
Bearing:					
F'theta			516		516
Capacity					
Joist			677		1161
Support			398		1195
Des ratio					
Joist			0.34		0.13
Support			0.58		0.13
Load comb			#3		#3
Length			0.50*		1.50
Min req'd			0.50*		0.50*
Cb			1.75		1.00
Cb min			1.75		1.00
Cb support			1.25		1.25
Fcp sup			425		425

*Minimum bearing length setting used: 1/2" for end supports and 1/2" for interior supports

Lumber-soft, S-P-F, No.1/No.2, 2x8 (1-1/2"x7-1/4")

Supports: All - Lumber-soft Beam, S-P-F No.1/No.2

Roof joist spaced at 16.0" c/c; Total length: 10.41'; Clear span(horz): 1.479', 7.038'; Volume = 0.8 cu.ft.; Pitch: 7/12

Lateral support: top = continuous, bottom = at supports; Repetitive factor: applied where permitted (refer to online help);

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 16	Fv' = 155	psi	fv/Fv' = 0.11
Bending(+)	fb = 223	Fb' = 1389	psi	fb/Fb' = 0.16
Bending(-)	fb = 51	Fb' = 1021	psi	fb/Fb' = 0.05
Deflection:				
Interior Live	0.02 = < L/999	0.41 = L/240	in	0.05
Total	0.06 = < L/999	0.55 = L/180	in	0.10
Cantil. Live	-0.01 = < L/999	0.17 = L/120	in	0.06
Total	-0.03 = L/633	0.23 = L/90	in	0.14

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	135	1.15	1.00	1.00	-	-	-	-	1.00	1.00	3
Fb'+	875	1.15	1.00	1.00	1.000	1.200	-	1.15	1.00	1.00	3
Fb'-	875	1.15	1.00	1.00	0.735	1.200	-	1.15	1.00	1.00	3
Fcp'	425	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.4 million		1.00	1.00	-	-	-	-	1.00	1.00	3
Emin'	0.51 million		1.00	1.00	-	-	-	-	1.00	1.00	3

CRITICAL LOAD COMBINATIONS:

```
Shear     : LC #3  = D + S
Bending(+): LC #3  = D + S
Bending(-): LC #3  = D + S
Deflection: LC #3  = D + S  (live)
            LC #3  = D + S  (total)
Bearing   : Support 1 - LC #3 = D + S
            Support 2 - LC #3 = D + S
Load Types: D=dead S=snow Lr=roof live
Load combinations: ASD Basic from ASCE 7-16 2.4; all LC's listed in the Analysis report
```

CALCULATIONS:

```
V max = 139, V design = 119 (NDS 3.4.3.1(a)) lbs
M(+) = 245 lbs-ft; M(-) = 55 lbs-ft
EI = 66.69e06 lb-in^2
"Live" deflection is due to all non-dead loads (live, wind, snow…)
Total deflection = 1.50 permanent + "live"
Bearing: Allowable bearing at an angle F'theta  calculated for each support
as per NDS 3.10.3
Lateral stability(-):  Lu = 8.19'  Le = 13.63'  RB = 22.9; Lu based on full span
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Continuous or Cantilevered Beams: NDS Clause 4.2.5.5 requires that normal grading provisions be extended to the middle 2/3 of 2 span beams and to the full length of cantilevers and other spans.
4. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
5. SLOPED BEAMS: level bearing is required for all sloped beams.
6. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

ASCE 7 - 16 WIND CALCULATION FOR: Roof 1 & Roof 3

Project Address: 7221 Willow Ave, Takoma Park, MD 20912, USA

DESIGN CRITERIA

Ultimate Wind Speed: 115 mph

Exposure Category: B

a: 3.75 ft

Velocity Pressure Exposure Coefficient, *Kz*: 0.57

Topographic Factor, *Kzt*: 1

Wind Directionality Factor, *Kd*: 0.85

Ground Elevation Factor, *Ke*: 1

Solar Array Pressure Equalization Factor, *ya*: 0.62 / 0

Array Edge Factor, γE: 1

Solar Array Dead Load: 3 psf

Mean Roof Height: 15 ft

Roof Pitch: 35°

Roof Type: Gable

Module Name, Dimensions, Area: HANWHA Q.TRON BLK M-G2+ 435W, 44.64in X 67.8in, 3026.59 sqin

CALCULATION

Velocity Pressure Due to Wind: $q_h = 0.00256(Kz)(Kzt)(Kd)(I)(V^2)$ $(Ch\ 26. Eq\ 26.10 - 1)$

Actual Uplift Pressure: $\mathrm{p} = 0.6D + 0.6W$ $(Ch\ 2.4.1\ LC\ \#7/a)$

Wind Uplift Pressure: $p = qh\ (GCp)(yE\ )(ya\ )$ $(Ch\ 29. Eq\ 29.4 - 7)$

Landscape / Portrait Panels

Roof Zone	1	2e	2n	2r	3e	3r
Mount Spacing	67.8”	67.8”	67.8”	67.8”	67.8”	67.8”
External Pressure Coefficient (GCp)	-1.78	-1.78	-1.98	-1.78	-2.47	-1.98
Actual Uplift Pressure (p)	-16 psf	-16 psf	-16 psf	-16 psf	-16 psf	-16 psf
Tributary Area (AT)	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft
Uplift Force (P)	-168.14 lbs	-168.14 lbs	-168.14 lbs	-168.14 lbs	-168.14 lbs	-168.14 lbs

Uplift Capacity

Attachment Type = 4 #14 Wood Screw 0.75" TopSpeed Mount Assembly

Hardware Pullout Capacity = 258 lbs

Safety Factor = 3

Maximum Uplift Force = 168.144 lbs

Allowable Pullout Capacity = 258 lbs

Allowable Pullout Capacity = 258 lbs > Uplift Force per Bolt = 168.14 lbs, Therefore OK.

EXACTUS ENERGY
NEW AGE ENGINEERING

ASCE 7 - 16 WIND CALCULATION FOR: Roof 2

Project Address: 7221 Willow Ave, Takoma Park, MD 20912, USA

DESIGN CRITERIA

Ultimate Wind Speed: 115 mph

Exposure Category: B

a: 3.75 ft

Velocity Pressure Exposure Coefficient, *Kz*: 0.57

Topographic Factor, *Kzt*: 1

Wind Directionality Factor, *Kd*: 0.85

Ground Elevation Factor, *Ke*: 1

Solar Array Pressure Equalization Factor, *ya*: 0.62 / 0

Array Edge Factor, γE: 1

Solar Array Dead Load: 3 psf

Mean Roof Height: 15 ft

Roof Pitch: 37°

Roof Type: Gable

Module Name, Dimensions, Area: HANWHA Q.TRON BLK M-G2+ 435W, 44.64in X 67.8in, 3026.59 sqin

CALCULATION

Velocity Pressure Due to Wind: $q_h = 0.00256(Kz)(Kzt)(Kd)(I)(V^2)$ $(Ch\ 26. Eq\ 26.10-1)$

Actual Uplift Pressure: $\mathrm{p} = 0.6D + 0.6W$ $(Ch\ 2.4.1\ LC\ \#7/a)$

Wind Uplift Pressure: $p = qh\ (GCp)(yE\ )(ya\ )$ $(Ch\ 29. Eq\ 29.4-7)$

Landscape / Portrait Panels

Roof Zone	1	2e	2n	2r	3e	3r
Mount Spacing	67.8”	67.8”	67.8”	67.8”	67.8”	67.8”
External Pressure Coefficient (GCp)	-1.78	-1.78	-1.98	-1.78	-2.47	-1.98
Actual Uplift Pressure (p)	-16 psf	-16 psf	-16 psf	-16 psf	-16 psf	-16 psf
Tributary Area (AT)	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft
Uplift Force (P)	-168.14 lbs	-168.14 lbs	-168.14 lbs	-168.14 lbs	-168.14 lbs	-168.14 lbs

Uplift Capacity

Attachment Type = 4 #14 Wood Screw 0.75" TopSpeed Mount Assembly

Hardware Pullout Capacity = 258 lbs

Safety Factor = 3

Maximum Uplift Force = 168.144 lbs

Allowable Pullout Capacity = 258 lbs

Allowable Pullout Capacity = 258 lbs > Uplift Force per Bolt = 168.14 lbs, Therefore OK.

EXACTUS ENERGY
NEW AGE ENGINEERING

ASCE 7 - 16 WIND CALCULATION FOR: Roof 4 & Roof 5

Project Address: 7221 Willow Ave, Takoma Park, MD 20912, USA

DESIGN CRITERIA

Ultimate Wind Speed: 115 mph

Exposure Category: B

a: 3.75 ft

Velocity Pressure Exposure Coefficient, *Kz*: 0.57

Topographic Factor, *Kzt*: 1

Wind Directionality Factor, *Kd*: 0.85

Ground Elevation Factor, *Ke*: 1

Solar Array Pressure Equalization Factor, *ya*: 0.66 / 0

Array Edge Factor, γE: 1

Solar Array Dead Load: 3 psf

Mean Roof Height: 15 ft

Roof Pitch: 31°

Roof Type: Gable

Module Name, Dimensions, Area: HANWHA Q.TRON BLK M-G2+ 435W, 44.64in X 67.8in, 3026.59 sqin

CALCULATION

Velocity Pressure Due to Wind: $q_h = 0.00256(Kz)(Kzt)(Kd)(I)(V^2)$ $(Ch\ 26. Eq\ 26.10-1)$

Actual Uplift Pressure: $\mathrm{p} = 0.6D + 0.6W$ $(Ch\ 2.4.1\ LC\ \#7/a)$

Wind Uplift Pressure: $p = qh\ (GCp)(yE\ )(ya\ )$ $(Ch\ 29. Eq\ 29.4-7)$

Landscape / Portrait Panels

Roof Zone	1	2e	2n	2r	3e	3r
Mount Spacing	67.8”	67.8”	67.8”	67.8”	67.8”	67.8”
External Pressure Coefficient (GCp)	-1.78	-1.78	-1.98	-1.78	-2.47	-1.98
Actual Uplift Pressure (p)	-16 psf	-16 psf	-16 psf	-16 psf	-14.75 psf	-16 psf
Tributary Area (AT)	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft	10.51 sqft
Uplift Force (P)	-168.14 lbs	-168.14 lbs	-168.14 lbs	-168.14 lbs	-154.98 lbs	-168.14 lbs

Uplift Capacity

Attachment Type = 4 #14 Wood Screw 0.75" TopSpeed Mount Assembly

Hardware Pullout Capacity = 258 lbs

Safety Factor = 3

Maximum Uplift Force = 168.144 lbs

Allowable Pullout Capacity = 258 lbs

Allowable Pullout Capacity = 258 lbs > Uplift Force per Bolt = 168.14 lbs, Therefore OK.

EXACTUS ENERGY
NEW AGE ENGINEERING

Solar Energy World
Because Tomorrow Matters

Project Roof Mounted Solar PV Installation Property Owner Jennifer Airoldi

Address 7221 Spruce Ave, Takoma Park, MD 20912, USA

☑ I reviewed the design of the photovoltaic (PV) system, as designed by the manufacturer, and the design criteria utilized for the mounting equipment and panel mounting assembly (rack system) for the installation of (15) panels supported by the rack system, as shown on the drawings prepared for the above referenced address. I certify that the configurations and design criteria meet the standards and requirements of the International Residential Code (IRC) in COMCOR 08.00.02.

☑ The attachment of the rack system to the building at the above address, including the location, number, and type of attachment points; the number of fasteners per attachment point; and the specific type of fasteners (size, diameter, length, minimum embedment into structural framing, etc.) meets the standards and requirements of the IRC adopted by Montgomery County in COMCOR 08.00.02.

☑ I evaluated the existing roof structure of the building at the above address and analyzed its capacity to support the additional loads imposed by the PV system. I certify that no structural modifications of the existing roof structure are required. The existing roof structure meets the standards and requirements of the IRC, adopted by Montgomery County in COMCOR 08.00.02, necessary to support the PV system.

□ I evaluated the existing roof structure of the building at the above address and analyzed its capacity to support the additional loads imposed by the PV system. Structural modifications of the existing roof structure are required. I certify that the roof structure, as modified on the drawings for this project, will support the additional loads imposed by the PV system. I further certify that design of the modified roof structure meets the standards and requirements of the IRC, adopted by Montgomery County in COMCOR 08.00.02.

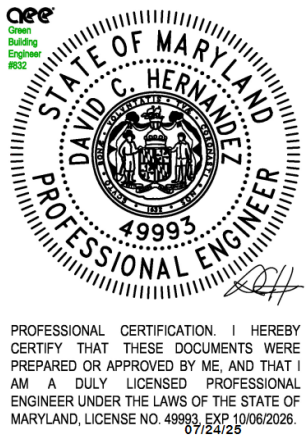
☑ I prepared or approved the construction documents for the mounting equipment, rack system, roof structure for this project.

Re-installations:
□ I certify that the reinstallation of the photovoltaic system (PV) as shown on the approved drawings for permit _____ (show original permit #) does not alter the approval under the permit or make the PV system, attachment to the building, and roof framing unsafe.

49993
Maryland PE License Number

Date 07/24/2025

Seal



Signature David C. Hernandez, PE

Digitally signed by David C. Hernandez, PE
Date: 2025.07.24 20:02:05 -04:00

Updated 11/14/2024

SolarEnergyWorld
Because Tomorrow Matters

Property Owners Name: Property Built in 1923

Property Owners Address: -Install (5) roof mounted solar panels on detached structure

Address of installation if different than owner's address:

I certify that:

- ☐ I prepared or approved the electrical drawings and related documents for the photovoltaic {PV) system at the above location.
- ☐ The design of the PV system, and all electrical Installations and equipment, meets the standards and requirements of the National Electrical Code as adopted by Montgomery County *in* COMCOR 17.02.01.
- ☐ I reviewed and completed the Worksheet for PV System, which was attached to the permit application for the PV system at the **above** location.

15732

State Master Electrician License Number

Date: 07/25/2025

Signature: Matt Kuss

City of Takoma Park

Housing and Community Development Department

Main Office 301-891-7119
Fax 301-270-4568
www.takomaparkmd.gov

7500 Maple Avenue
Takoma Park, MD 20912

MUNICIPALITY LETTER

July 25, 2025

To: Jennifer Airoldi
7221 Spruce Avenue, Takoma Park, MD 20912
jairoldi@gmail.com 410-992-2021

To: Department of Permitting Services
2425 Reedie Drive, 7th floor
Wheaton, Maryland 20902

From: Planning and Development Services Division

THIS IS NOT A PERMIT – For Informational Purposes Only

VALID FOR ONE YEAR FROM DATE OF ISSUE

The property owner is responsible for obtaining all required permits from Montgomery County and the City of Takoma Park. If this property is in the **Takoma Park Historic District,** it is subject to Montgomery County Historic Preservation requirements.

Representative Name: Tina Crouse-Solar EnergyWorld tcrouse@solarenergyworld.com 410-570-4157
Location of Project: 7221 Spruce Avenue
Proposed Scope of Work: Install (15) roof mounted solar panel, 6.52 kW

The purpose of this municipality letter is to inform you that the City of Takoma Park has regulations and city permit requirements that may apply to your project. This municipality letter serves as notification that, in addition to all Montgomery County requirements, you are required to comply with all City permitting requirements, including:

- Tree Impact Assessment/Tree Protection Plan
- Stormwater management
- City Right of Way

Failure to comply with these requirements could result in the issuance of a Stop Work Order and other administrative actions within the provisions of the law. Details of Takoma Park's permit requirements are attached on page 2.

The issuance of this letter does not indicate approval of the project nor does it authorize the property owner to proceed with the project. The City retains the right to review and comment on project plans during the Montgomery County review process.

City Of Takoma Park

The City of Takoma Park permits for the following issues:

Tree Impact Assessment/Tree Protection Plan/Tree Removal Application:

Construction activities that occur within 50 feet of any urban forest tree (7 and 5/8" in trunk diameter or greater), located on the project property or on an adjacent property, may require a Tree Impact Assessment and possibly a Tree Protection Plan Permit. Make sure to submit a request for a Tree Impact Assessment and schedule a site visit with the City's Urban Forest Manager if any urban forest tree is in the vicinity of proposed construction activities. See the Tree Permits section of the City website for the specific conditions in which a Tree Impact Assessment is required. Depending on the Urban Forest Manager's conclusion following the Tree Impact Assessment, you may need to prepare a full Tree Protection Plan and apply for a Tree Protection Plan Permit as well. Separately, the removal of any urban forest tree will require a Tree Removal Permit application. The tree ordinance is detailed in the City Code, section 12.12. For permit information check: https://takomaparkmd.gov/services/permits/tree-permits. The City's Urban Forest Manager can be reached at 301-891-7612 or urbanforestmanager@takomaparkmd.gov.

Stormwater Management:

If you plan to develop or redevelop property, you may be required to provide appropriate stormwater management measures to control or manage runoff, as detailed in City Code section 16.04. All commercial or institutional development in the city must apply for a Stormwater Management Permit regardless of the size of the land disturbance. Additions or modifications to existing detached single-family residential properties do not require a Stormwater Management permit if the project does not disturb more than 5,000 square feet of land area. For more information visit: https://takomaparkmd.gov/government/public-works/stormwater-management-program/. The City Engineer should be contacted to determine if a City permit is required. The City Engineer can be reached at 301-891-7620.

City Right of Way:

- To place a **construction dumpster or storage container** temporarily on a City right of way (usually an adjacent road), you will need to obtain a permit. A permit is not required if the dumpster is placed in a privately-owned driveway or parking lot.
- If you plan to install a new **driveway apron**, or enlarge or replace an existing driveway apron, you need a Driveway Apron Permit.
- If you plan to construct a **fence** in the City right of way, you need to request a Fence Agreement. If approved, the Agreement will be recorded in the Land Records of Montgomery County.

For more information and applications for City permits, see: https://takomaparkmd.gov/services/permits/ or contact the Department of Public Works at 301-891-7633.

Failure to comply with the City's permitting requirements could result in the issuance of a Stop Work Order and other administrative actions within the provisions of the law.

eSigned via GovOS.com
Tina Crouse
Key: 38bf2056622713c0bf979ea7ee94776a

Tina Crouse 07-25-2025

eSigned via GovOS.com
Takoma Park Planning Division
Key: 19fe84f123e68a3ff457621905 9d5fbe

07-25-2025

DEPARTMENT OF PERMITTING SERVICES

Marc Elrich
County Executive

Rabbiah Sabbakhan
Director

HISTORIC AREA WORK PERMIT APPLICATION

Application Date: 7/25/2025

Application No: 1126843
AP Type: HISTORIC
Customer No: 1408761

Affidavit Acknowledgement

The Contractor is the Primary applicant authorized by the property owner
This application does not violate any covenants and deed restrictions

Primary Applicant Information

Address	7221 SPRUCE AVE TAKOMA PARK, MD 20912
Othercontact	Solar Energy World (Primary)

Historic Area Work Permit Details

Work Type	ALTER
Scope of Work	INSTALL (15) ROOF MOUNTED SOLAR PANELS, 6.52 KW

Q.TRON BLK M-G2+ SERIES

415 - 440 Wp | 108 Cells
22.5 % Maximum Module Efficiency

MODEL Q.TRON BLK M-G2+

High performance Qcells N-type solar cells

Q.ANTUM NEO Technology with optimized module layout boosts module efficiency up to 22.5 %.

A reliable investment

Inclusive 25-year product warranty and 25-year linear performance warranty[1].

Enduring high performance

Long-term yield security with Anti LeTID Technology, Anti PID Technology[2], Hot-Spot Protect.

Extreme weather rating

High-tech aluminium alloy frame, certified for high snow (8100 Pa) and wind loads (3600 Pa).

Innovative all-weather technology

Optimal yields, whatever the weather with excellent low-light and temperature behaviour.

The most thorough testing programme in the industry

Qcells is the first solar module manufacturer to pass the most comprehensive quality programme in the industry: The new “Quality Controlled PV” of the independent certification institute TÜV Rheinland.

[1] See data sheet on rear for further information.
[2] APT test conditions according to IEC/TS 62804-1:2015, method A (–1500 V, 96 h)

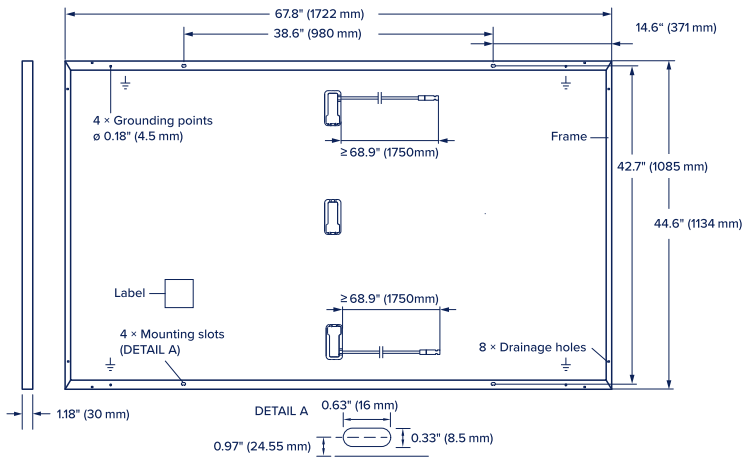
The ideal solution for:

Rooftop arrays on residential buildings

Q.TRON BLK M-G2+ SERIES

Mechanical Specification

Format	67.8 in × 44.6 in × 1.18 in (including frame) (1722 mm × 1134 mm × 30 mm)
Weight	46.7 lbs (21.2 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodised aluminium
Cell	6 × 18 monocrystalline Q.ANTUM NEO solar half cells
Junction box	2.09-3.98 in × 1.26-2.36 in× 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), Protection class IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥68.9 in (1750mm), (−) ≥68.9 in (1750mm)
Connector	Stäubli MC4; IP68

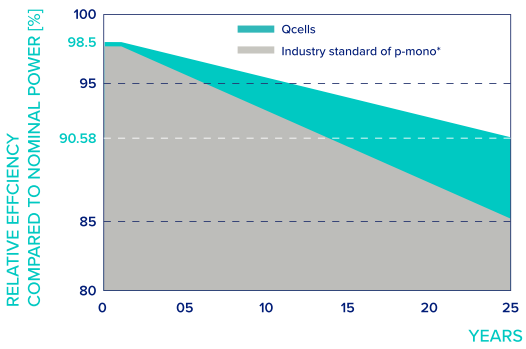


Electrical Characteristics

POWER CLASS			415	420	425	430	435	440
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W/−0 W)								
Minimum	Power at MPP[1]	P_{MPP}	[W]	415	420	425	430	435	440
	Short Circuit Current[1]	I_{SC}	[A]	13.49	13.58	13.66	13.74	13.82	13.90
	Open Circuit Voltage[1]	V_{OC}	[V]	38.47	38.75	39.03	39.32	39.60	39.88
	Current at MPP	I_{MPP}	[A]	12.83	12.91	12.98	13.05	13.13	13.20
	Voltage at MPP	V_{MPP}	[V]	32.34	32.54	32.74	32.94	33.14	33.33
	Efficiency[1]	η	[%]	≥21.3	≥21.5	≥21.8	≥22.0	≥22.3	≥22.5
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]								
Minimum	Power at MPP	P_{MPP}	[W]	313.7	317.5	321.2	325.0	328.8	332.6
	Short Circuit Current	I_{SC}	[A]	10.87	10.94	11.00	11.07	11.14	11.20
	Open Circuit Voltage	V_{OC}	[V]	36.50	36.77	37.04	37.31	37.58	37.84
	Current at MPP	I_{MPP}	[A]	10.10	10.15	10.21	10.27	10.33	10.38
	Voltage at MPP	V_{MPP}	[V]	31.07	31.26	31.46	31.65	31.84	32.03

[1]Measurement tolerances P_{MPP} ±3%; I_{SC}; V_{OC} ±5% at STC: 1000 W/m², 25±2 °C, AM 1.5 according to IEC 60904-3 • [2]800 W/m², NMOT, spectrum AM 1.5

Qcells PERFORMANCE WARRANTY

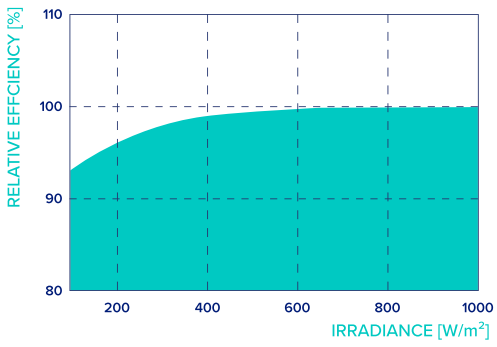


At least 98.5% of nominal power during first year. Thereafter max. 0.33% degradation per year. At least 95.53% of nominal power up to 10 years. At least 90.58% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organisation of your respective country.

*Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²).

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.24
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.30	Nominal Module Operating Temperature	NMOT	[°F]	109±5.4 (43±3 °C)

Properties for System Design

Maximum System Voltage	V_{SYS}	[V]	1000 (IEC)/1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating		[A DC]	25	Fire Rating based on ANSI/UL 61730	C / TYPE 2
Max. Design Load, Push/Pull[3]		[lbs/ft²]	113 (5400 Pa)/50 (2400 Pa)	Permitted Module Temperature on Continuous Duty	−40 °F up to +185 °F (−40 °C up to +85 °C)
Max. Test Load, Push/Pull[3]		[lbs/ft²]	169 (8100 Pa)/75 (3600 Pa)		

[3] See Installation Manual

Qualifications and Certificates

Quality Controlled PV -
TÜV Rheinland;
IEC 61215:2016;
IEC 61730:2016.
This data sheet complies
with DIN EN 50380.

*UL and California Energy Commission (CEC) listings pending

Qcells pursues minimizing paper output in consideration of the global environment.

Note: Installation instructions must be followed. Contact our technical service for further information on approved installation of this product.
Hanwha Q CELLS America Inc. 400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL +1 949 748 59 96 | EMAIL hqc-inquiry@qcells.com | WEB www.qcells.com

ENPHASE

DATA SHEET

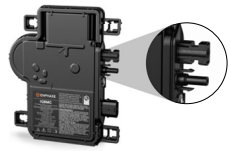
IQ8MC Microinverter

Our newest IQ8 Series Microinverters are the industry's first microgrid-forming*, software-defined microinverters with split-phase power conversion capability to convert DC power to AC power efficiently. The brain of the semiconductor-based microinverter is our proprietary application-specific integrated circuit (ASIC), which enables the microinverter to operate in grid-tied or off-grid modes. This chip is built in advanced 55-nm technology with high-speed digital logic and has superfast response times to changing loads and grid events, alleviating constraints on battery sizing for home energy systems.

Part of the Enphase Energy System, IQ8 Series Microinverters integrate with the IQ Battery, IQ Gateway, and the Enphase App monitoring and analysis software.

Enphase 25 year limited warranty

IQ8 Series Microinverters redefine reliability standards with more than one million cumulative hours of power-on testing, enabling an industry-leading limited warranty of up to 25 years.



Connect PV modules quickly and easily to the IQ8 Series Microinverters that have integrated MC4 connectors.

UL CERTIFIED SAFETY

IQ8 Series Microinverters are UL Listed as PV rapid shutdown equipment and conforms with various regulations when installed according to the manufacturer's instructions.

*Meets UL 1741 only when installed with IQ System Controller 2 or 3.

Easy to install

- Lightweight and compact with plug-and-play connectors
- Power line communication (PLC) between components
- Faster installation with simple two-wire cabling

High productivity and reliability

- Produces power even when the grid is down*
- More than one million cumulative hours of testing
- Class II double-insulated enclosure
- Optimized for the latest high-powered PV modules

Microgrid-forming

- Complies with the latest advanced grid support
- Remote automatic updates for the latest grid requirements
- Configurable to support a wide range of grid profiles
- Meets CA Rule 21 (UL 1741-SA) and IEEE 1547:2018 (UL 1741-SB)

NOTE:

- IQ8 Microinverters cannot be mixed together with previous generations of Enphase microinverters (IQ7 Series, IQ6 Series, and so on) in the same system.
- IQ Microinverters ship with default settings that meet North America's IEEE 1547 interconnection standard requirements. Region-specific adjustments may be requested by an Authority Having Jurisdiction (AHJ) or utility representative. An IQ Gateway is required to make these changes during installation.

IQ8MC Microinverter

INPUT DATA (DC)	UNITS	IQ8MC-72-M-US
Commonly used module pairings [1]	W	260–460
Module compatibility	—	To meet compatibility, PV modules must be within the following max. input DC voltage and max. module I_{sc}. Module compatibility can be checked at https://enphase.com/installers/microinverters/calculator.
MPPT voltage range	V	25–45
Operating range	V	18–58
Min./Max. start voltage	V	22/58
Max. input DC voltage	V	60
Max. continuous operating DC current	A	14
Max. input DC short-circuit current	A	25
Max. module I_{sc}	A	20
Overvoltage class DC port	—	II
DC port backfeed current	mA	0
PV array configuration	—	Ungrounded array; no additional DC side protection required; AC side protection requires max 20 A per branch circuit

OUTPUT DATA (AC)	UNITS	IQ8MC-72-M-US @240 VAC	IQ8MC-72-M-US @208 VAC
Peak output power	VA	330	315
Max. continuous output power	VA	320	310
Nominal grid voltage (L-L)	V	240, split-phase (L-L), 180°	208, single-phase (L-L), 120°
Min./Max. grid voltage [2]	V	211–264	183–229
Max. continuous output current	A	1.33	1.49
Nominal frequency	Hz	60	
Extended frequency range	Hz	47–68	
AC short circuit fault current over three cycles	Arms	2.70	
Max. units per 20 A (L-L) branch circuit [3]	—	12	10
Total harmonic distortion	%	<5	
Overvoltage class AC port	—	III	
AC port backfeed current	mA	18	
Power factor setting	—	1.0	
Grid-tied power factor (adjustable)	—	0.85 leading ... 0.85 lagging	
Peak efficiency	%	97.4	97.2
CEC weighted efficiency	%	97.0	96.5
Nighttime power consumption	mW	33	25

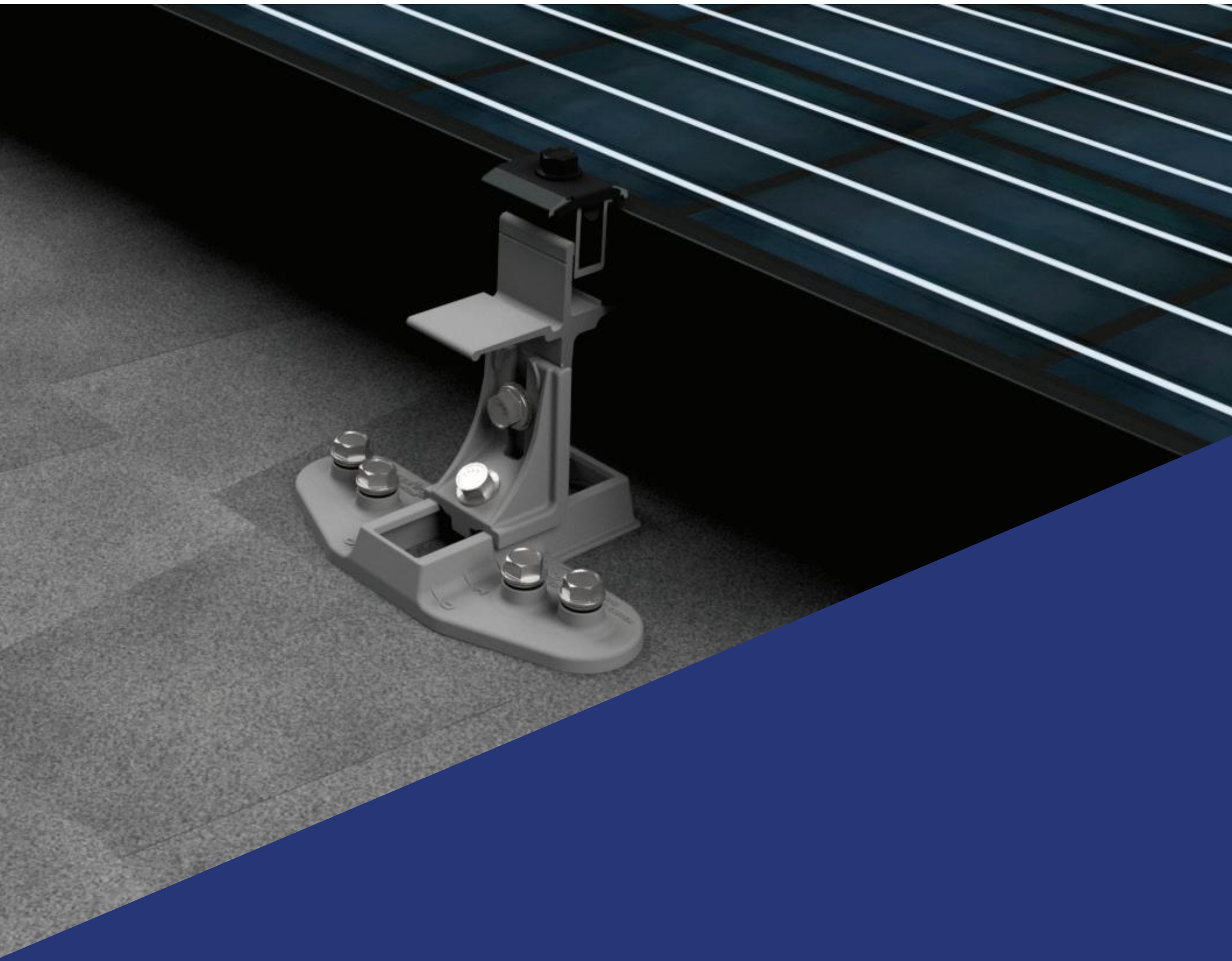
MECHANICAL DATA	UNITS
Ambient temperature range	-40°C to 65°C (-40°F to 149°F)
Relative humidity range	4% to 100% (condensing)
DC connector type	Stäubli MC4
Dimensions (H × W × D); Weight	212 mm (8.3") × 175 mm (6.9") × 30.2 mm (1.2"); 1.1 kg (2.43 lbs)
Cooling	Natural convection – no fans
Approved for wet locations; Pollution degree	Yes; PD3
Enclosure	Class II double-insulated, corrosion-resistant polymeric enclosure
Environ. category; UV exposure rating	NEMA Type 6; outdoor

COMPLIANCE	
Certifications	CA Rule 21 (UL 1741-SA), UL 62109-1, IEEE 1547:2018 (UL 1741-SB), FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01. This product is UL Listed as PV rapid shutdown equipment and conforms with NEC 2014, NEC 2017, NEC 2020, and NEC 2023 section 690.12 and C22.1-2018 Rule 64-218 rapid shutdown of PV systems for AC and DC conductors when installed according to the manufacturer's instructions.

(1) No enforced DC/AC ratio.
(2) Nominal voltage range can be extended beyond nominal if required by the utility.
(3) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

Revision history

REVISION	DATE	DESCRIPTION
DSH-00049-4.0	February 2024	Added information about IEEE 1547 interconnection standard requirements.
DSH-00049-3.0	October 2023	Included NEC 2023 specification in the “Compliance” section.
DSH-00049-2.0	September 2023	Updated module compatibility information.
DSH-00049-1.0	May 2023	Preliminary release.



SnapNrack™

Solar Mounting Solutions

TopSpeed™ Mounting System

Installation Manual

snapnrack.com

An Intro to SnapNrack TopSpeed™ with SpeedSeal™ Technology

snapnrack.com

SnapNrack's primary goal is to provide our customers with the lowest possible installed cost for mounting residential solar modules, without compromising the values the industry has come to expect: ease of use, quality, aesthetics, and safety. Designing with this goal in mind, we are proud to present the SnapNrack TopSpeed™ mounting system with SpeedSeal™ Technology.

SnapNrack has created a ground breaking system combining great features and benefits we are known for, with our TopSpeed™ System and the most up to date technical innovation in the industry, thus reducing parts while driving down labor, material, and total installation costs. Designed to work with standard module frames, achieving UL 2703 Listing for Grounding/ Bonding and Fire Classification, providing integrated wire management, aesthetics and our industry leading "Snap-In" features, SnapNrack is providing the simplest and most cost effective solar mounting solution on the market with TopSpeed™ including integrated fasteners and SpeedSeal™ Technology.

Advantages of Installing the SnapNrack TopSpeed™ System

Modules are installed with a minimum number of parts

This elimination of parts leads to a lower estimated system cost for both the installer and home owner.

Built in Wire Management and Aesthetics

Extensive wire management solutions have been designed specifically for the system that adapts to multiple possible mounting positions.

The system is designed to be aesthetically pleasing and sturdy with a skirt that provides considerable strength at the leading edge and an elegant look for those seeking high end looking systems.

SnapNrack TopSpeed™ includes SpeedSeal™ Technology

SpeedSeal™ Technology features integrated flashing. This eliminates loosening layers of composition and removing nails with a pry bar, leading to less damage to the roof, minimized potential roof leaks, and much faster installs.

TopSpeed™ Mounts attach Directly to the Decking

As well as all of the benefits associated with the standard SpeedSeal™ Technology, TopSpeed™ attaches to the roof sheathing and does not require rafter attachment. Simply attaching to the roof sheathing removes the requirement for finding rafters and drilling pilot holes, creating potential rafter misses that can cause leaks.

Table of Contents

snapnrack.com

Certification Details

SnapNrack TopSpeed™ mounting system has been evaluated by Underwriters Laboratories (UL) and Listed to UL Standard 2703 for Grounding/Bonding, and Fire Classification.

Grounding/Bonding

Only specific components have been evaluated for bonding, and are identified as being in the ground path. The TopSpeed™ components that have been evaluated for bonding are the Mount Assembly (Mount Clamp Top, Module Clamp Tower, Angle Bracket), Clamp Assembly, Universal Skirt, Universal Skirt Clamp, Ground Lugs, and Smart Clips.

Universal Skirt Spacers, Mount Channel Nut, and Mount Base are not required to be bonded to the system based on the exceptions in clause 9.1 of UL 2703 1st Ed. Wire management clips are utilized to route conductors away from these components and must be assembled according to the instructions.

This mounting system may be used to ground and/or mount a PV module complying with UL 1703 or UL 61703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions. See Appendix A for the list of modules tested for use with the TopSpeed™ System for integrated grounding.

Ground Lugs have been evaluated to both UL 467 and UL 2703 Listing requirements. The following ground lugs have been approved for use: SnapNrack model 242-92202, and Ilsco models GBL-4DBT and SGB-4.

The following components have been evaluated for bonding as the fault current ground path: TopSpeed™ Mount Assembly, (Mount Clamp Top, Module Clamp Tower, Angle Bracket), Clamp Assembly, Wire Management Clips, and Ground Lugs. In order to maintain the Listing for bonding, wire management clips must be assembled to route conductors away from parts that have not been evaluated for bonding.

A Listed (QIMS) and Unlisted Component (KDER3) grounding lug, SnapNrack part no. 242-92202, is attached to the module frame flange for the normal attachment of a Grounding Electrode Conductor, which provides bonding within the system and eventual connection to a Grounding Electrode, as required by the U.S. NEC. Details of part no. 242-92202 can be found in Volume 1, Section 4, and Volume 2, Section 2. When this method is used, the grounding symbol is stamped onto the body of the ground lug to identify the grounding terminal.

An alternate method of grounding, a UL Listed (KDER and QIMS) grounding lug, Ilsco (E34440 and E354420) model SGB-4 is attached to the module frame flange. When this method is used, the grounding terminal is identified by the green colored screws of the lug.

An alternate method of grounding, a UL Listed (KDER and QIMS) grounding lug, Ilsco (E34440 and E354420) model GBL-4BDT is attached to the module frame flange through the specified hardware and torque values. When this method is used, the grounding terminal is identified by the green colored set screw of the lug.

An alternate method of grounding, Enphase R/C (QIKH2)(QIMS2) model M250, M215 & C250 is bonded to the Listed PV module frame by the Enphase R/C (QIMS2) Model EFM-XXMM anodization piercing mounting/clamping kit. The total roof-mounted PV system is bonded (modules and microinverters) together and the assembly is bonded to ground through the Enphase R/C (QIMS2) Engage Cables; Model ETXX-240, ETXX-208 or ETXX-277, when properly grounded at the service entrance.
R/C (QIMS2), Dynoraxx (E357716) photovoltaic bonding device cat. no. Dynobond is an optional component that may be used with this system. The Dynobond device has been evaluated to provide module to module bonding. The Dynobond device attaches to the frame flange of adjacent modules Listed (QIMS), SnapNrack MLPE Frame Attachment Kit model 242-02151 has been investigated to bond approved MLPE device back plates to frames of modules.

Fire

SnapNrack TopSpeed™ has been investigated for a Class A System Fire Classification for Steep-Sloped and low sloped roofs with Type 1 and Type 2 modules. Because the system was tested at 5 inches above the test roof fixture, TopSpeed™ can be installed without any height restrictions due to System Fire Classification. See Appendix A for potential module-specific height restrictions due to module temperature. The Skirt is considered an optional component with respect to Fire Classification, as SnapNrack TopSpeed™ maintains the same Fire Classification Rating both with and without the skirt.

NOTE: Modules with an asterisk* have a fire rating that is different from Type 1, Type 2 or Type 29. SNR systems have only been evaluated for use with Type 1, Type 2, or Type 29 modules. Modules with a different fire type rating should be considered to not have been evaluated for use with SNR systems with respect to a system fire rating.

Inspection Practices

SnapNrack recommends a periodic re-inspection of the completed installation for loose components, loose fasteners, and any corrosion, such that if found, the affected components are to be immediately replaced.

Component Details

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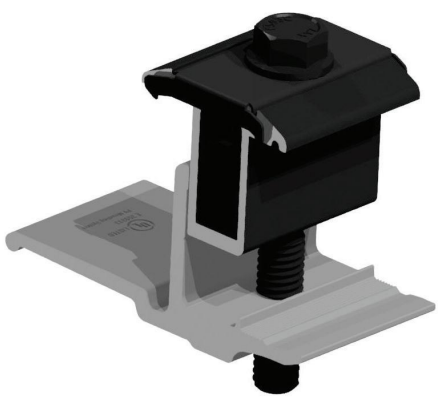
TopSpeed™ Structural Components

TopSpeed™ Mount

SnapNrack TopSpeed™ Mount assembly including SpeedSeal™ base, clamp top, and (4) SnapNrack #14 SS Wood Screws with 1/2" Hex Head.



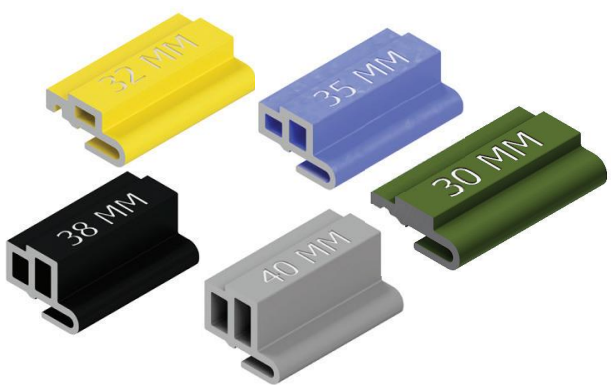
TopSpeed™ Clamp

SnapNrack TopSpeed™ Clamp assembly including including Link bottom, Link top, and springs.

Universal Skirt

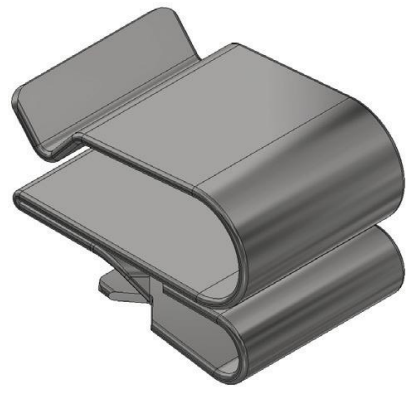
SnapNrack Universal Skirt in double portrait or single landscape lengths.

Wire Managements Components



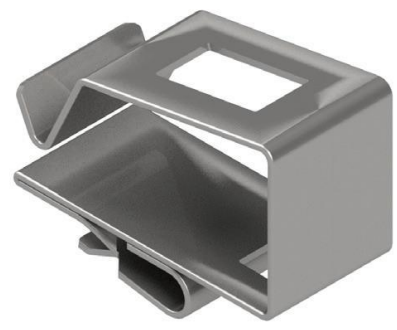
Skirt Spacers

SnapNrack Universal Skirt Spacer for 40mm, 38mm, 35mm, 32mm, and 30mm modules.



Smart Clip

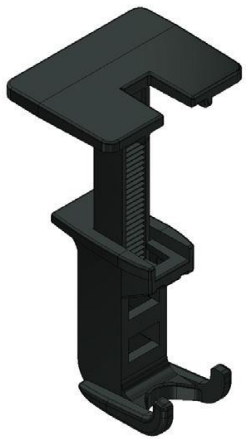
Module frame cable clip, holds two PV wires or Enphase IQ-Cables.



Smart Clip XL

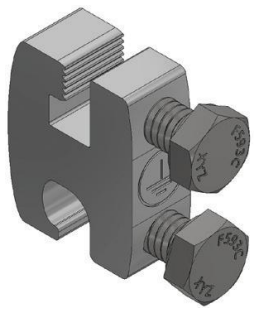
Module frame cable clip, holds six PV wires or four Enphase IQ-Cable.

Grounding/MLPE Components



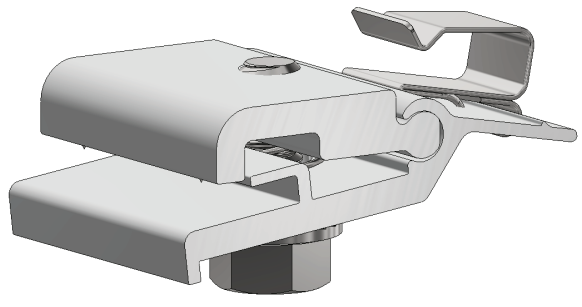
Wire Saver

Designed to secure conductors that become loose and hang below the array, holds one conductor.



Ground Lug

SnapNrack Ground Lug assembly used for attaching the Equipment Grounding Conductor on to one module or any TopSpeed™ Mount per array.



MLPE Frame Attachment Kit

Attaches MLPEs (Module Level Performance Enhancers) and other related equipment to the module frame.

Component Details

Hardware Torque Specifications

The recommended torque to be applied to components for proper assembly and bonding are as follows:

Hardware Description	Torque Specification
All TopSpeed™ ½" bolts; System Leveling Bolt, TopSpeed™ Mount Clamping Bolt, Clamp Bolt	16 ft-lb
Ground Lug model 242-92202 to Module Frame or anywhere on the TopSpeed™ Mount, and Ground Lug model 242-92202 to Grounding Electrode Conductor (6-12 SOL)	8 ft-lb
MLPE Frame Attachment Kit, MLPE Rail Attachment Kit	10 ft-lb
SolarEdge Frame Mounted Microinverter Bracket to Module Frame	11 ft-lb
Enphase Frame Mounted Microinverter Bracket to Module Frame	13 ft-lb
Ground Lug model SGB-4 to module	75 in-lb
Ground Lug model SGB-4 to Grounding Electrode Conductor (4-14 SOL or STR)	35 in-lb
Ground Lug model GBL-4DBT to module	35 in-lb
Ground Lug model GBL-4DBT to Grounding Electrode Conductor (10-14 SOL or STR)	20 in-lb
Ground Lug model GBL-4DBT to Grounding Electrode Conductor (8 SOL or STR)	25 in-lb
Ground Lug model GBL-4DBT to Grounding Electrode Conductor (4-6 SOL or STR)	35 in-lb

Pre-Installation Requirements

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Site Survey

- Measure the roof surfaces and develop an accurate drawing, including any obstacles such as chimneys and roof vents.
- If plans for the roof structure are available, verify that the plans match the final structure.
- Identify any roof access or setback areas as required by the local AHJ.
- Identify any construction issues that may complicate the process of locating rafters from the roof surface.
- If you find structural problems such as termite damage or cracked rafters that may compromise the structure's integrity consult a structural engineer.

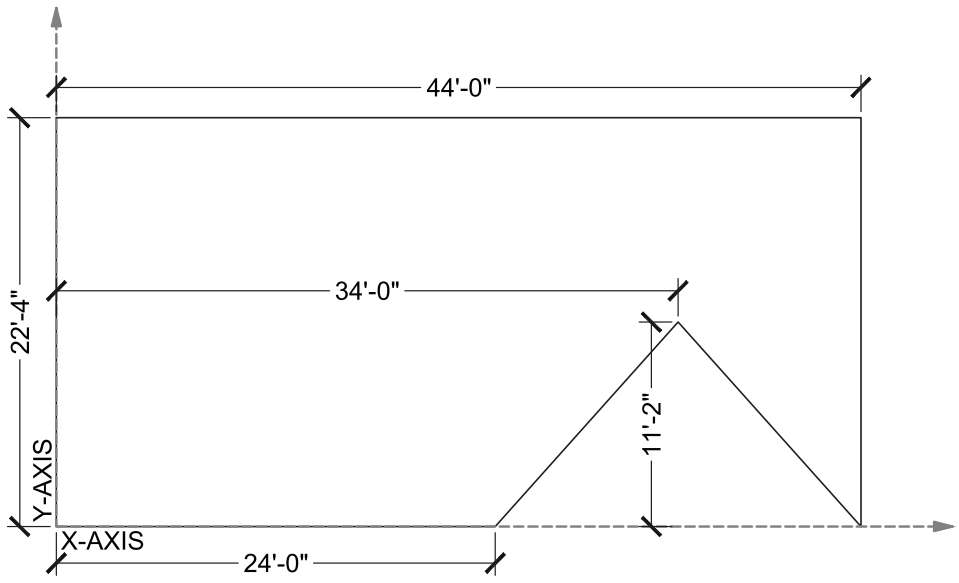
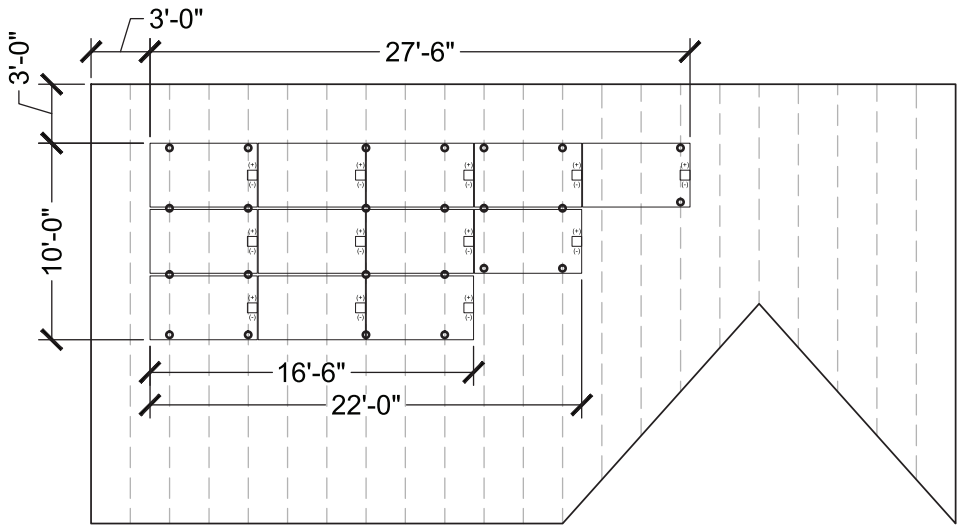


Image note: X-Axis described in this manual is cross-slope on the roof, Y-Axis is in line with the roof slope.

Design Guidance

- PV Designers should account for the 0.75 inch spacing between rows and columns of modules when creating the layout.
- Determine site conditions for calculating the engineering values, confirm site conditions and code versions comply with local AHJ requirements.
- Reference site conditions and system specifications in TopSpeed™ Structural Engineering Report to determine the number of attachments per module side.
- Insert SnapNrack installation details into design plan set specific to the project requirements.
- Draw roof attachment locations on plan set layout based on TopSpeed™ Structural Engineering.



Best Practice:

If environmental load conditions require three TopSpeed™ attachments per module side this is only required when modules share attachments.

- Identify homerun and Junction Box locations based on rooftop wiring requirements.
- Mark distance from array edge to identifiable roof feature in x and y axes.

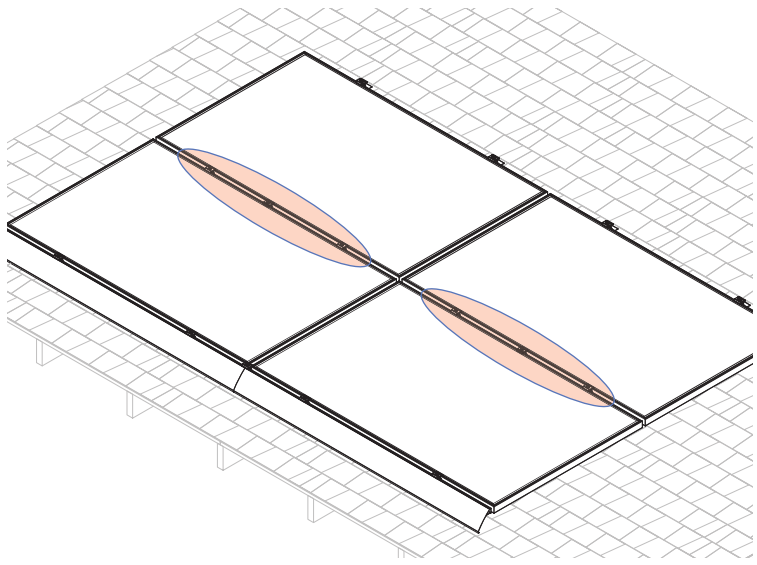


Image note: This four module array is installed in a high load configuration with three attachments per side where two modules share attachments. See highlighted area. As shown, three attachments are never required at the skirt or the top of the array.

Safety Guidance

- **Always wear appropriate OSHA approved safety equipment when at active construction site.**
- **Appropriate fall protection or prevention gear should be used. Always use extreme caution when near the edge of a roof.**
- **Use appropriate ladder safety equipment when accessing the roof from ground level.**

Safety Guidance Continued

- **Safety equipment should be checked periodically for wear and quality issues.**
- **Always wear proper eye protection when required.**

TopSpeed™ Mount to Module Frame Installation

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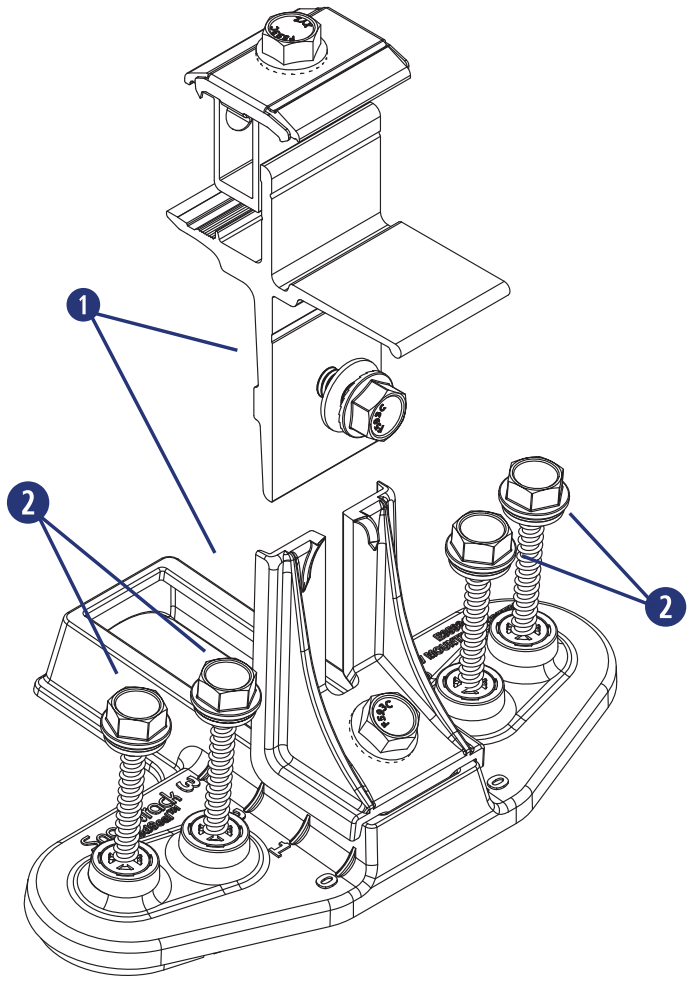
Required Tools

- Socket Wrench/Impact Driver
- Torque Wrench
- 1/2” Socket

Materials Included - TopSpeed™ System with SpeedSeal™ Technology

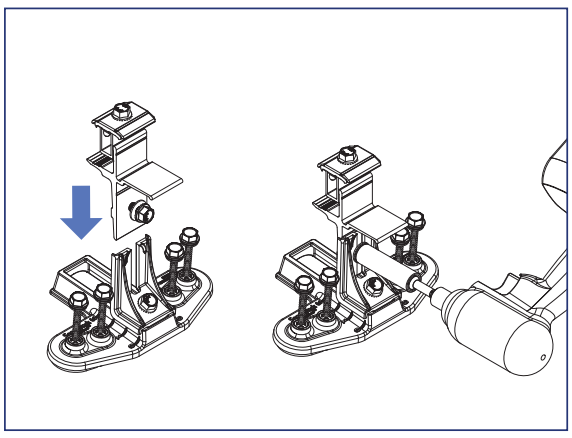
1. (1) SnapNrack TopSpeed™ Mount
2. (4) SnapNrack #14 Wood Screw with 1/2" Hex Head & sealing washer



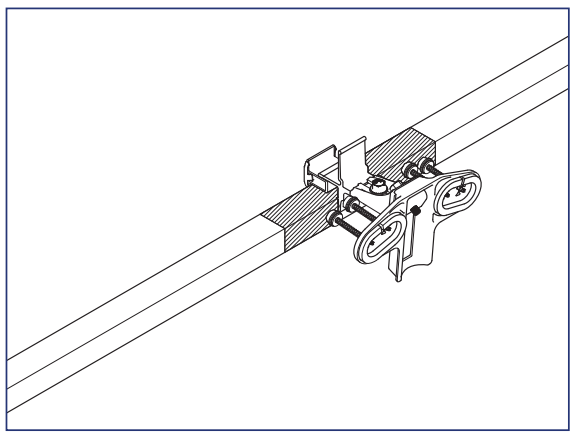
Best Practice:

Attach all TopSpeed™ mounts as the modules are being prepped with MLPEs on the ground. Attach Mounts before attaching MLPEs to simplify wire management.

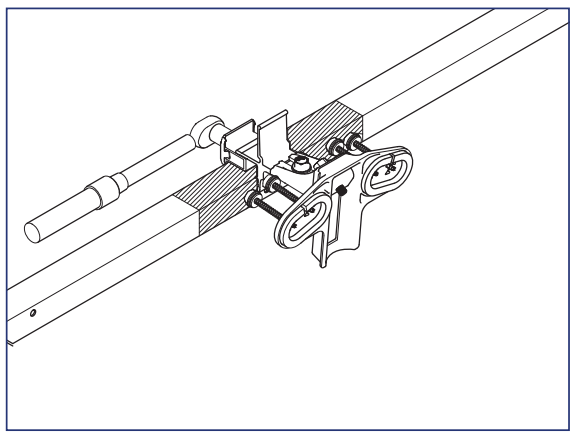
INSTALLATION INSTRUCTIONS



1) Assemble all TopSpeed™ Mounts required for the installation. Slide the clamp tower assembly into the angle bracket riser and tighten the leveling bolt to 16 ft-lbs.



2) Position TopSpeed™ Mount clamp on the module frame within the module manufacturers required clamping zone.



3) Tighten 1/2" clamping bolt to 16 ft-lb. Only two Mounts are required per module on one side.

Install Note:

For high load conditions add a third attachment in the middle of the module frame.

TopSpeed™ Universal Skirt Layout

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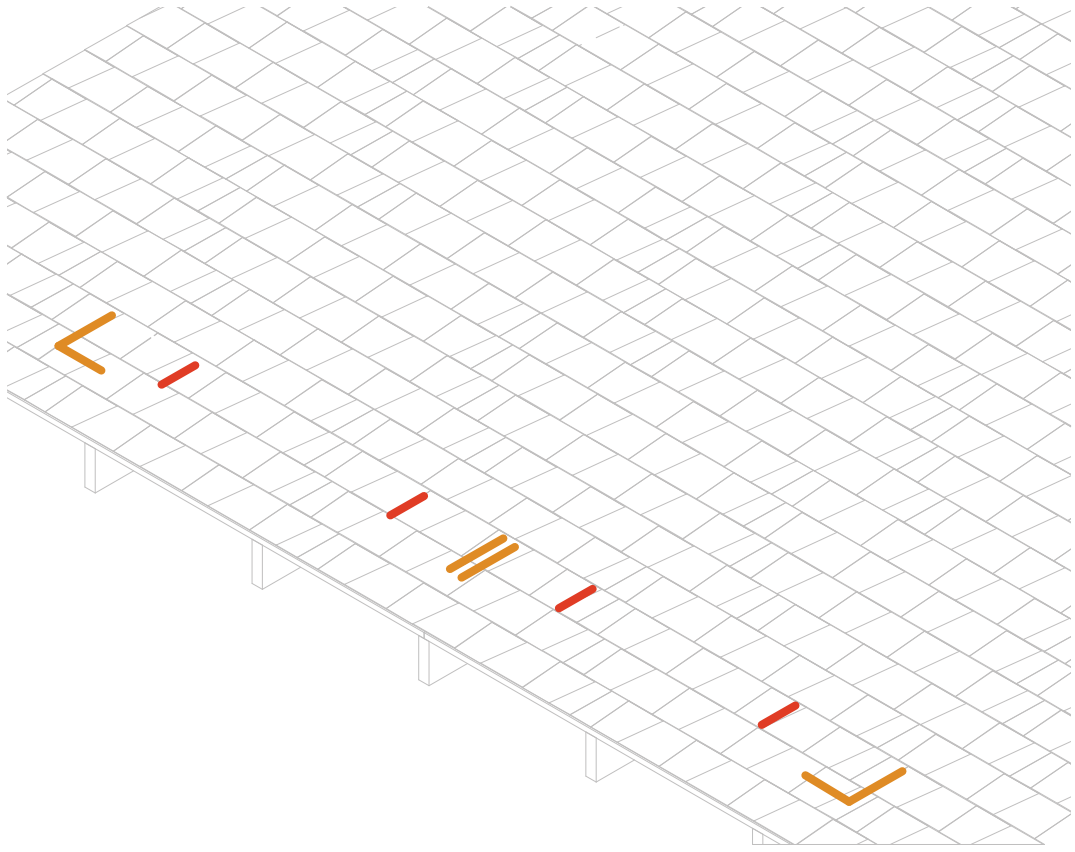
Required Tools

- Roof Marking Crayon or Chalk
- Tape Measure

LAYOUT INSTRUCTIONS

1) Use a tape measure to verify that all modules will fit properly on the roof surface.

2) On the roof draw the layout for the skirt installation including module gaps (recommended 0.75 inch gap), bottom corners, and locations of the two TopSpeed™ attachments per module that clamp to the skirt. Three attachments per module is never required at the skirt.



Install Note:

If environmental load conditions require three TopSpeed™ attachments per module side this is only required when modules share attachments.

TopSpeed™ Mount: Skirt Installation

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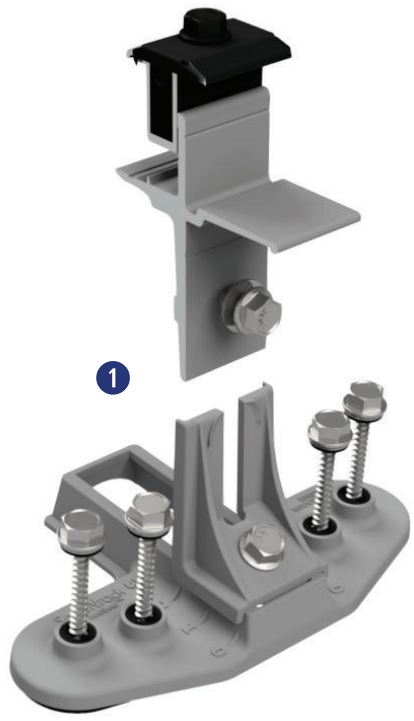
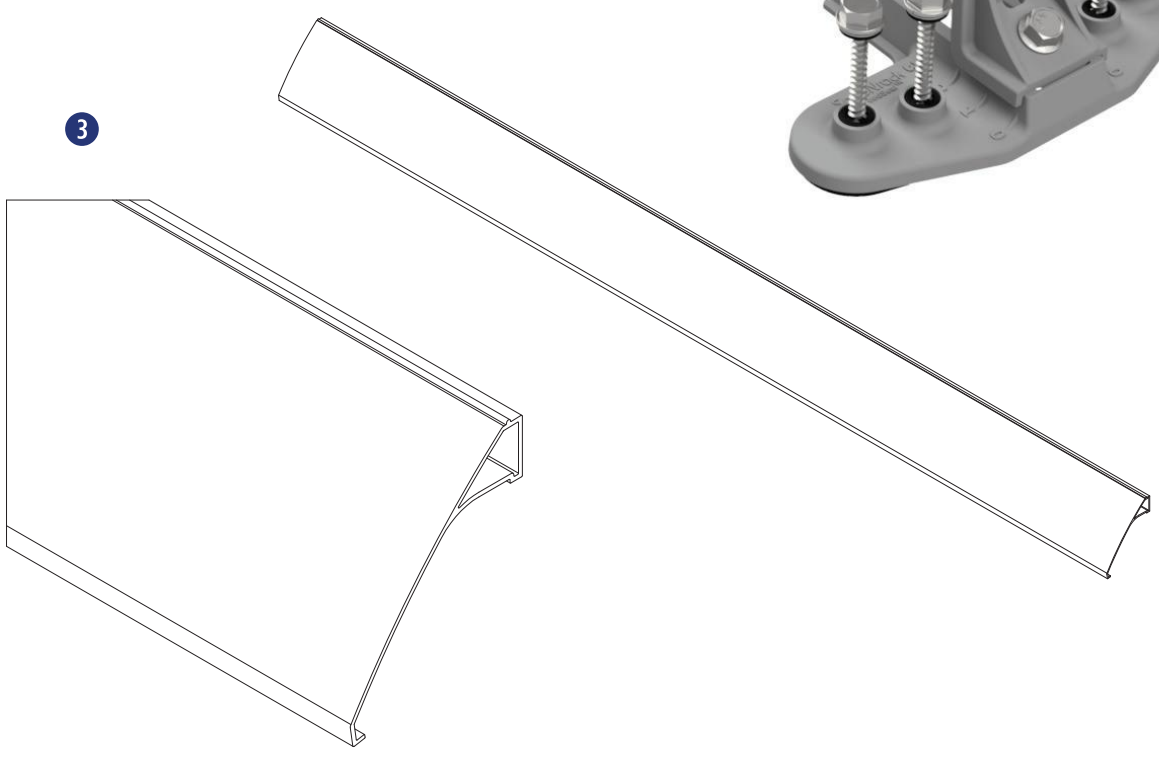
Required Tools

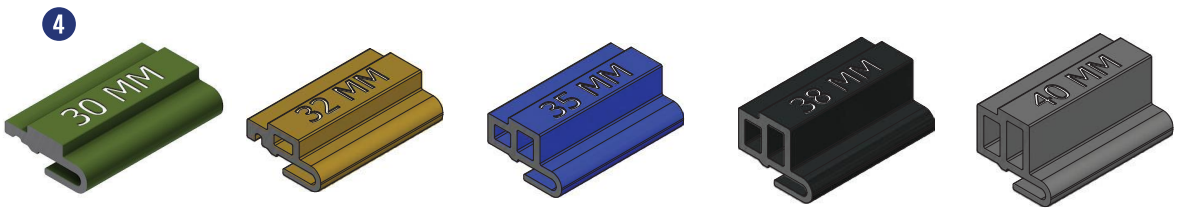
- Socket Wrench/Impact Driver
- Torque Wrench
- 1/2” Socket
- Roofing sealant

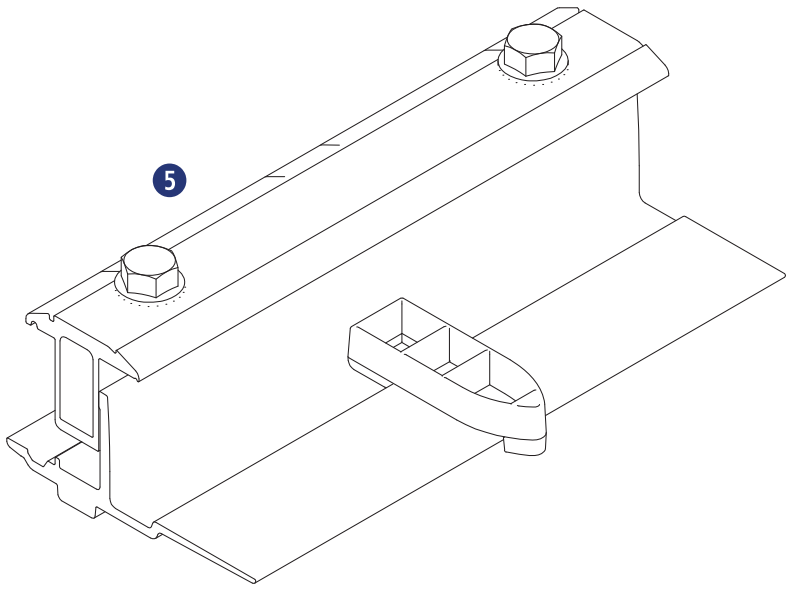
Materials Included - TopSpeed™ Mount with SpeedSeal™ Technology

1. (1) TopSpeed™ Mount
2. (1) TopSpeed™ Clamp
3. (1) Universal Skirt
4. (1) Universal Skirt Spacers
5. (1) *OPTIONAL* - Universal Link









TopSpeed™ Mount Skirt Installation

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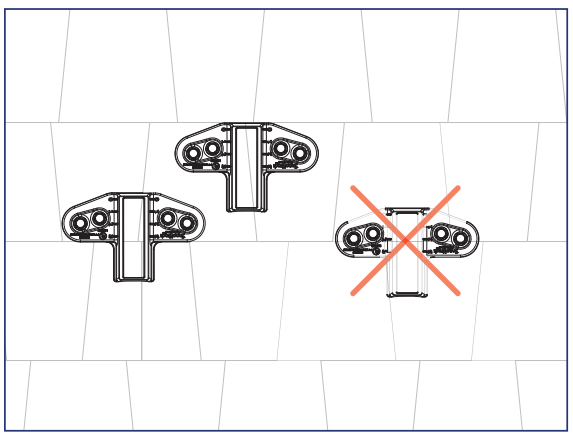
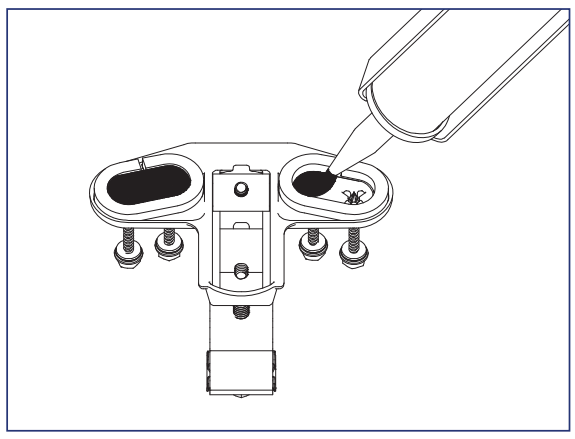
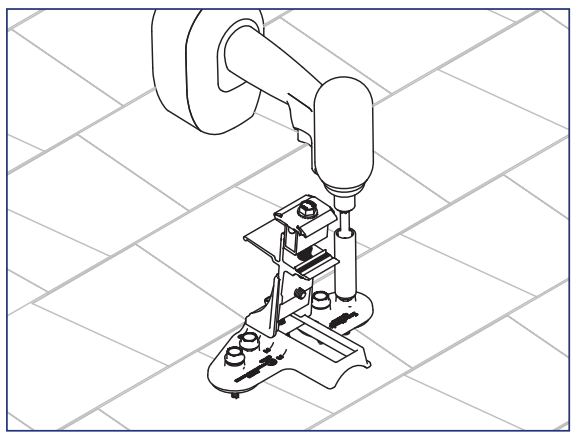
INSTALLATION INSTRUCTIONS



1) Install TopSpeed™ Mounts at locations drawn during the skirt layout. Mounts must be installed entirely on one course of composition.



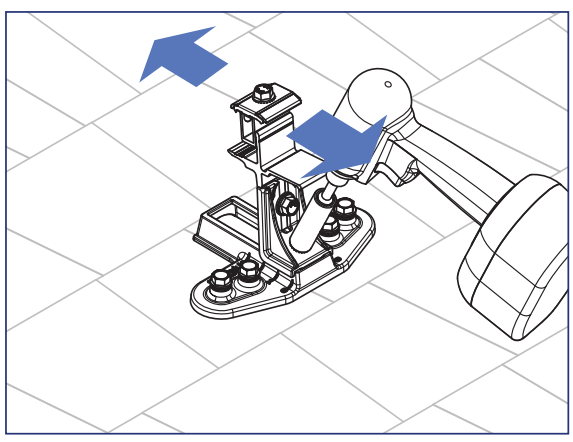
2) Fill both cavities on bottom of TopSpeed™ Mount created by SpeedSeal™ gasket with roof sealant to ensure a watertight seal.



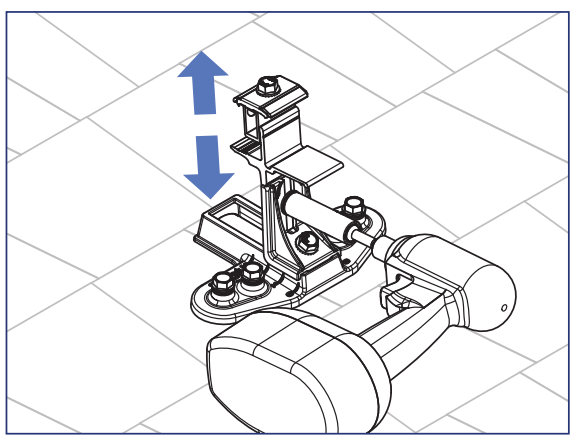
3) Attach TopSpeed™ Mount to roof using the (4) SnapNrack #14 Wood Screws with 1/2" hex head that are captured in the Mount.

Install Note:

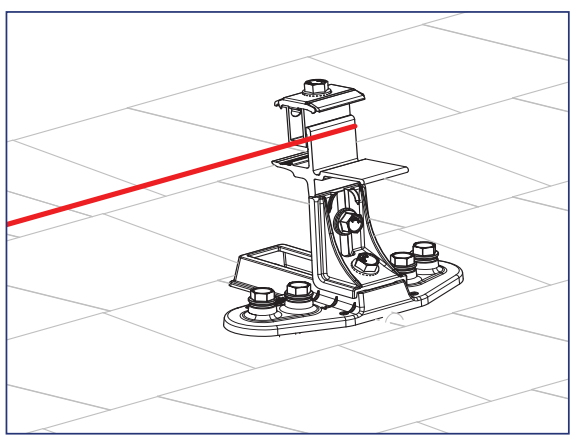
Roof sealant should be expelled from both vents of the TopSpeed™ Mount as it is installed to assure the proper amount of roof sealant has been applied. If sealant is not expelled from all four vents, remove TopSpeed™ Mount, add more sealant to the cavity, then reinstall.



4) Loosen Course Adjustment bolt and adjust end Mounts up or down until aligned with bottom edge of array as marked on the roof, then tighten the Course Adjustment bolt.



5) To set the TopSpeed™ Mount level loosen the Leveling bolt and move the clamp up or down, then tighten the Leveling bolt and torque to 16 ft-lb.



6) Pull string line tight from one corner mount to opposite corner mount to align and level all TopSpeed™ Mounts between the end mounts.

Install Note:

Use the string line alignment feature on Mounts to level and align the Mounts.

TopSpeed™ Mount Skirt Installation

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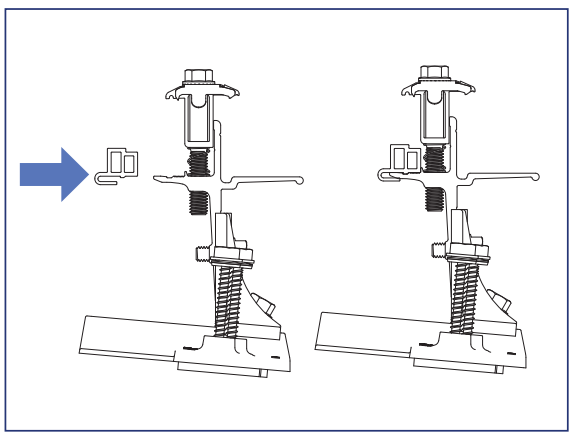
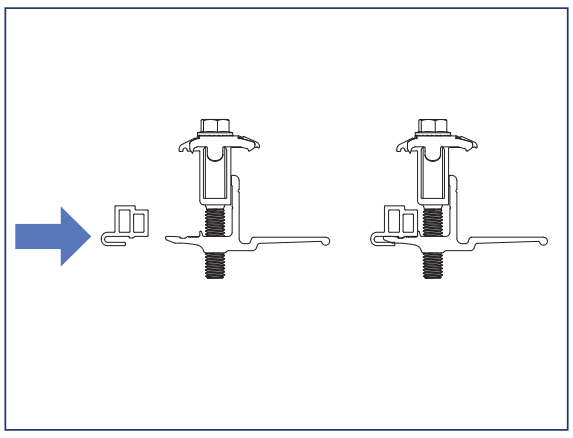
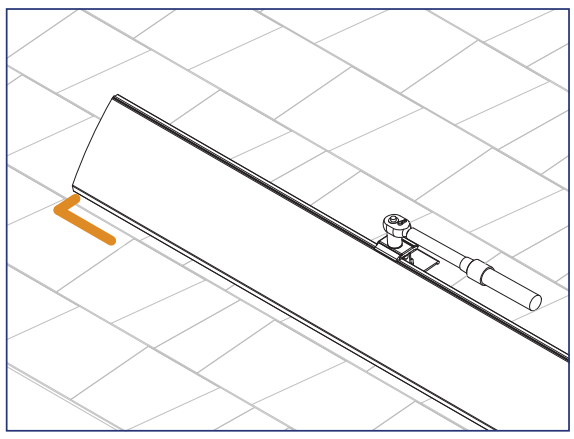
INSTALLATION INSTRUCTIONS

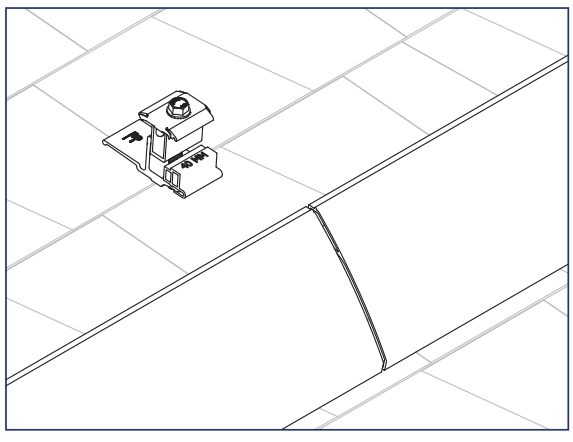


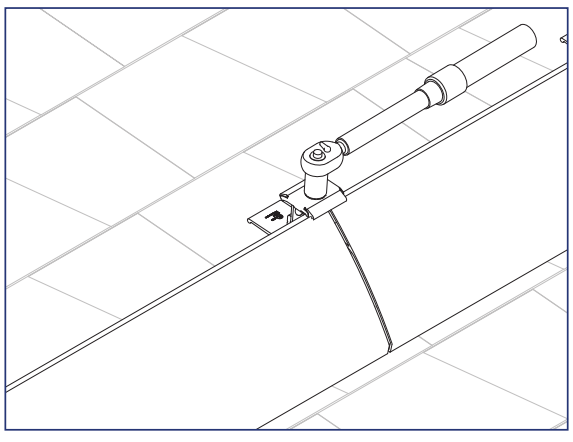




7) Universal Spacers will need to be added to Mounts and Clamps where Skirt will be installed.

8) Install Universal Skirt by holding the skirt in Mount, sliding Skirt to align with array layout marks, and clamping skirt into mount.





9) Use TopSpeed™ Clamps to connect multiple lengths of Array Skirt.

Install Note:

Optionally use Universal Links to connect lengths of Array Skirt.

Wire Management

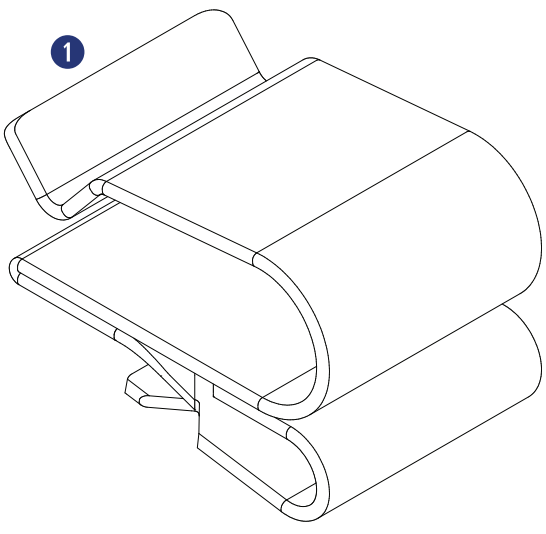
Required Tools

- Socket Wrench
- Torque Wrench
- 1/2” Socket
- Electrician Tools

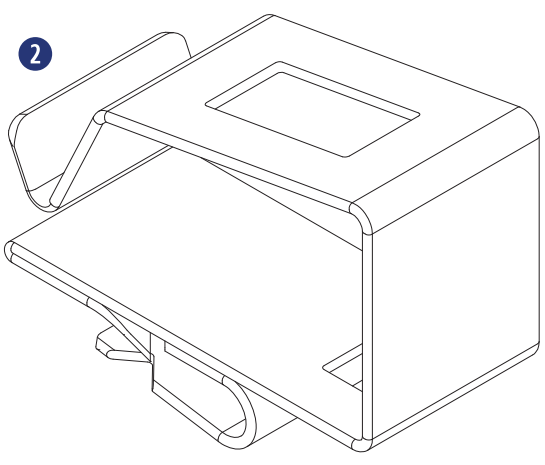
Materials Included

Smart Clips

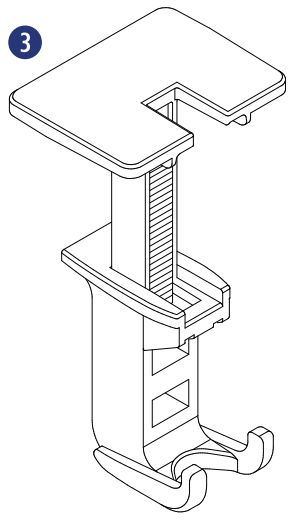
1. (1) Smart Clip [(2) PV Wire, (1) Enphase IQ Cable]
2. (1) Smart Clip XL [(6) PV Wire, (4) Enphase IQ]
3. (1) Wire Saver [(1) PV Wire]



Smart Clip



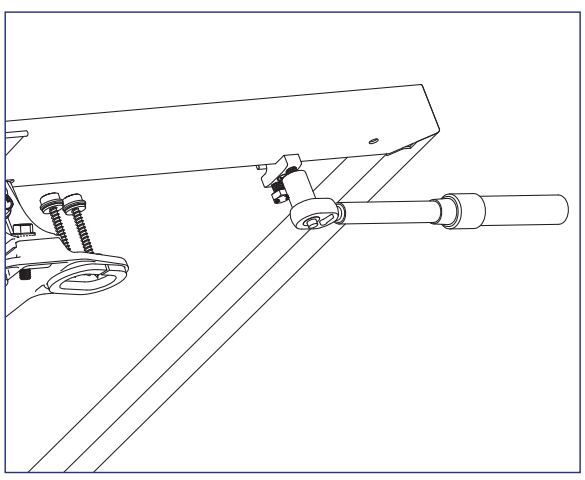
Smart Clip XL



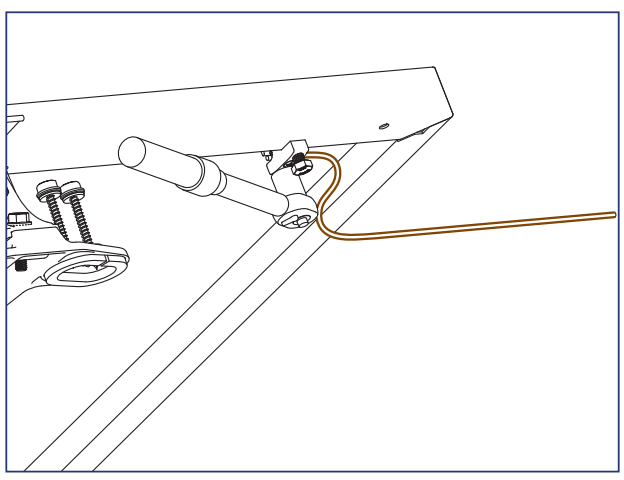
Wire Saver

INSTALLATION INSTRUCTIONS - GROUND LUG

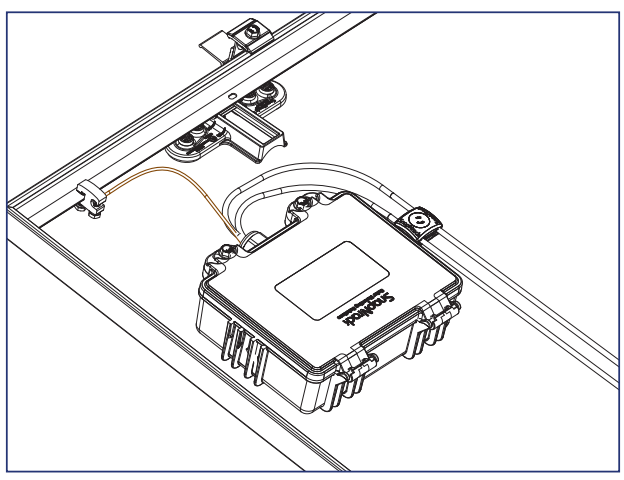
The SnapNrack Ground Lug to be used in accordance with the National Electric Code, ANSI/NFPA 70.



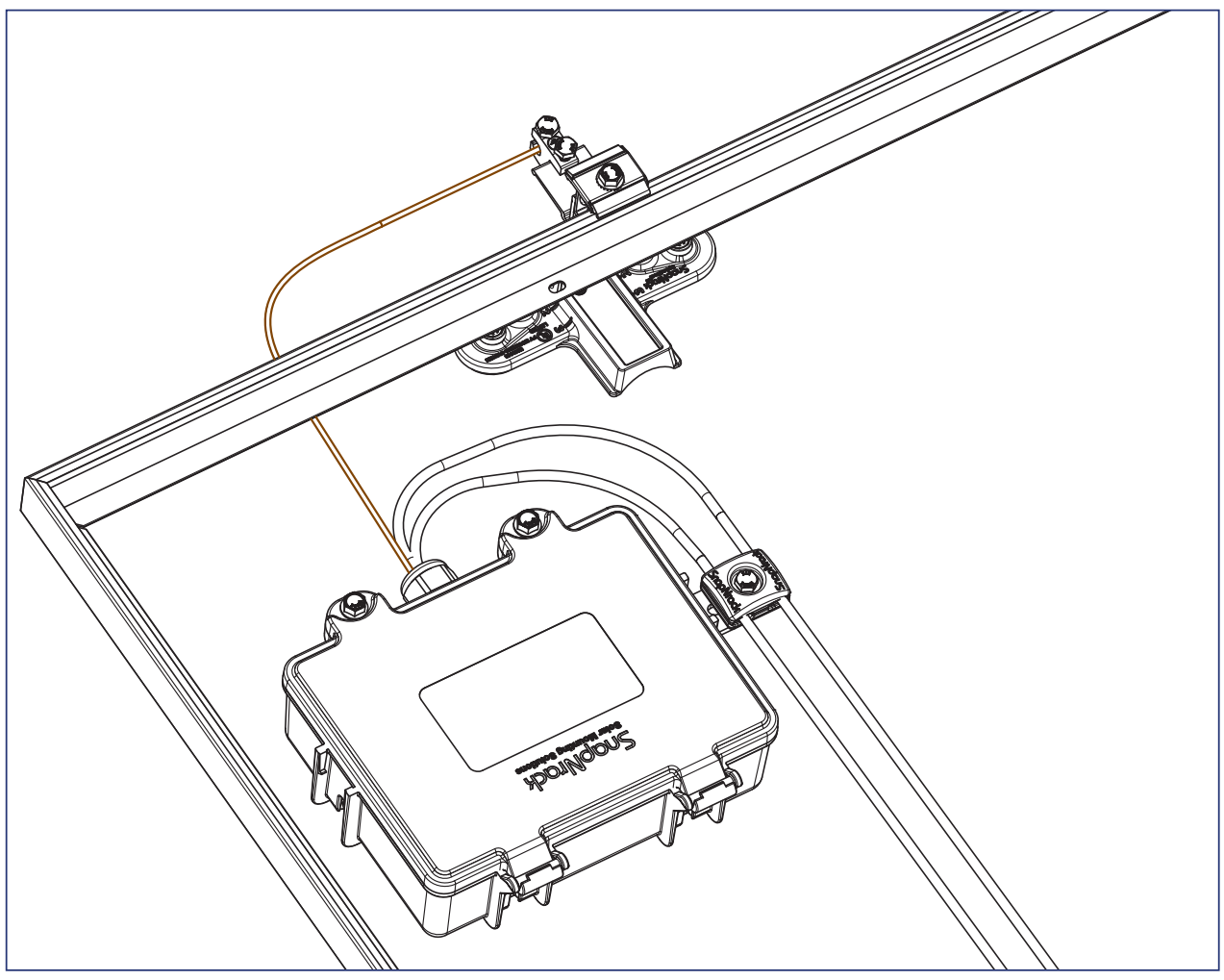
1) Ground Lug (242-92202) can be attached anywhere along the module frame or any TopSpeed™ Mount near the Junction Box. Torque module clamping bolt to 8 ft-lb.



2) Run 10 – 6 AWG, solid, bare copper GEC into Ground Lug channel, torque wire clamping bolt to 8 ft-lb.



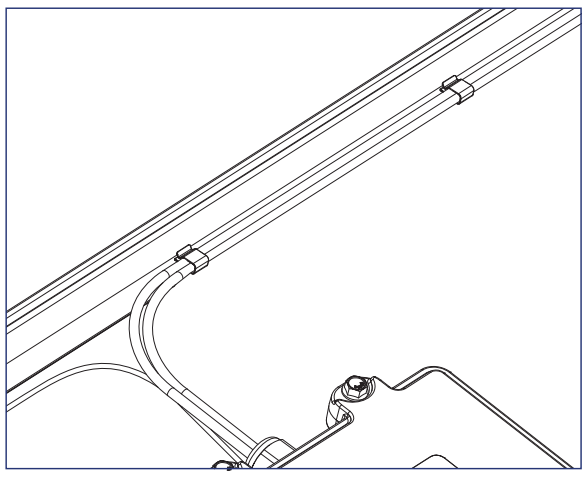
3) Run bare, solid EGC from Ground Lug R to Junction Box, bond bare EGC to stranded EGC in Junction Box. For details on installing the Junction Box reference the **Junction Box Installation Manual.**



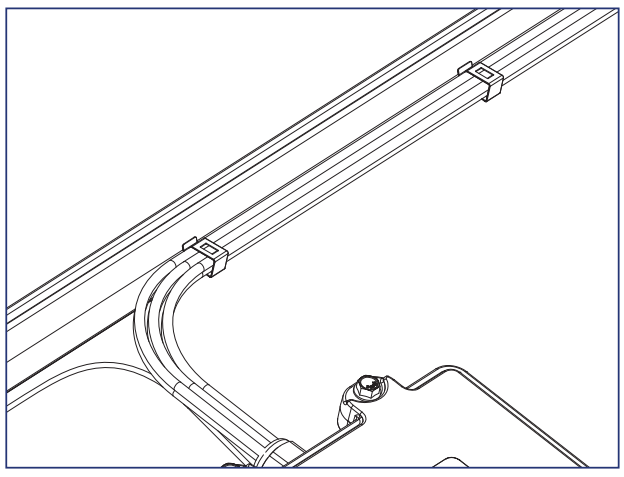
4) Optionally; Install Ground Lug on the Mount Landing Pad at the top of the array. Run bare copper between ground lug and Junction Box.

INSTALLATION INSTRUCTIONS - SMART CLIPS

SmartClip and SmartClip XL should be used to route conductors in a neat and workmanlike manner away from all non-bonded components and support the conductors adequately to eliminate potential damage.



1) Use SnapNrack Smart Clip II to manage up two PV wires inside the module frame while prepping out the modules on the ground or installing modules on the roof.



2) Use SnapNrack Smart Clip XL to manage larger bundles of PV wire; up to 6 PV wires per clip

MLPE & RSD Installation

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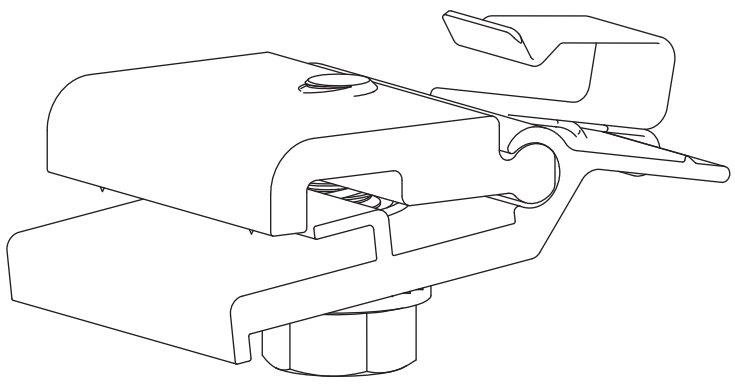
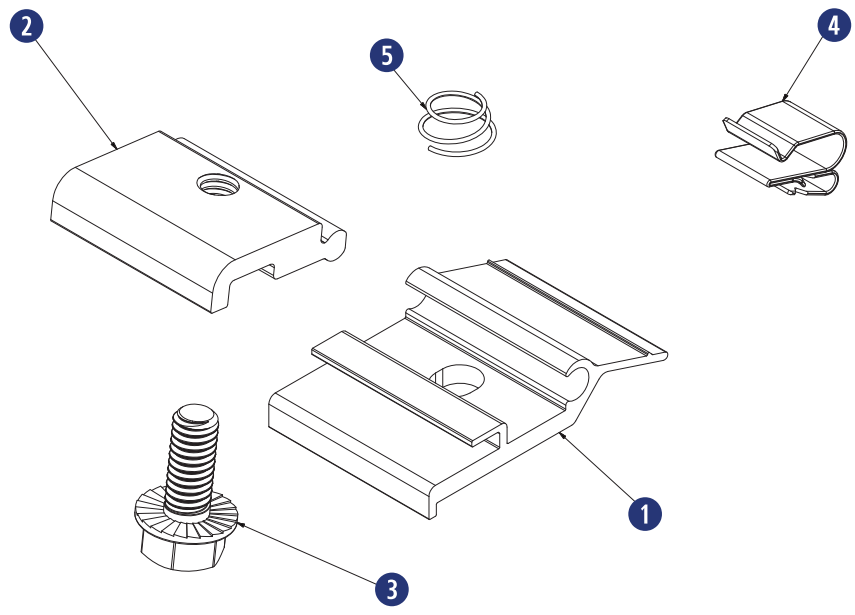
Required Tools

- Socket Wrench
- Torque Wrench
- 1/2” Socket

Materials Included - MLPE Rail Attachment Kit

1. (1) SnapNrack MLPE Frame Attachment Top
2. (1) SnapNrack MLPE Frame Attachment Bottom
3. (1) 5/16”-18 X 3/4” Serrated Flange Bolt SS
4. (1) SnapNrack Smart Clip
5. (1) SnapNrack MLPE Frame Attachment Coil Spring SS

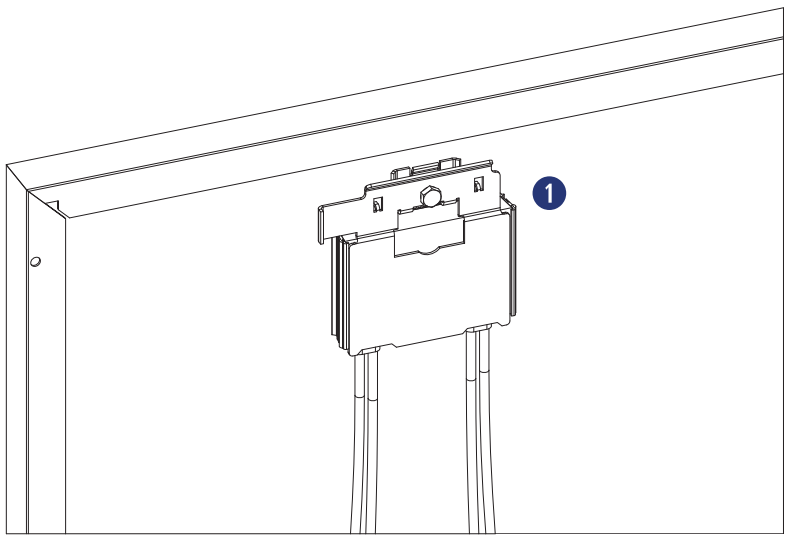




Materials Included

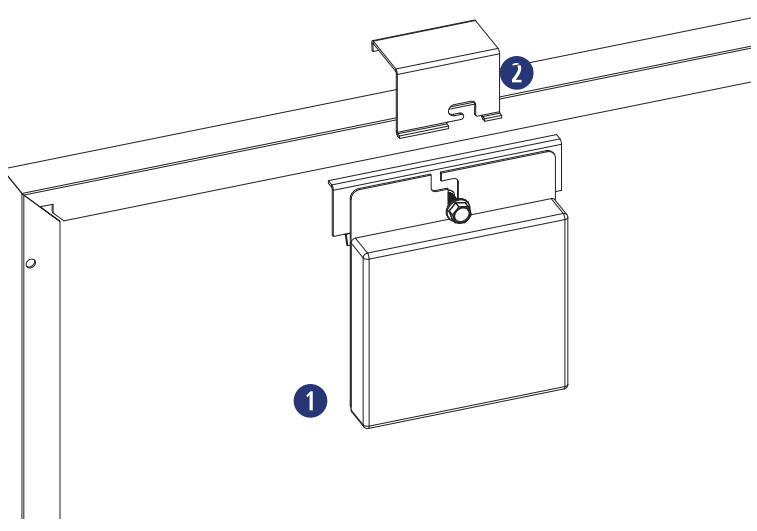
SolarEdge Frame Mount

1. (1) SolarEdge Optimizer w/ Frame-Mounted Module Add-On



Enphase Frame Mount

1. (1) Enphase Microinverter
2. (1) Enphase Frame Mount



MLPE & RSD Installation

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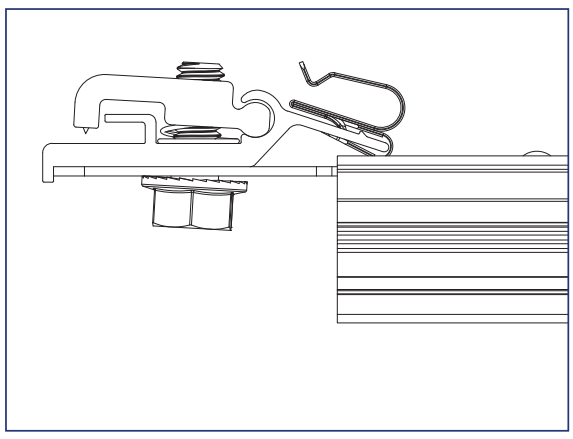
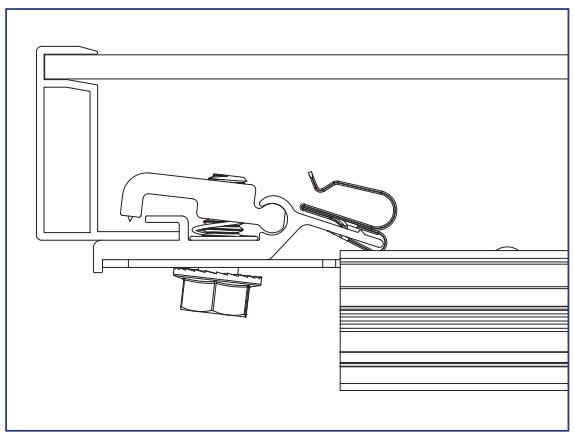
INSTALLATION INSTRUCTIONS - SNAPNRACK MLPE FRAME ATTACHMENT KIT

SnapNrack MLPE Frame Attachment kit are used to attach module level performance enhancing devices, and other devices such an SRD (rapid shutdown device), directly to module frames, and provide integrated grounding/bonding for Devices grounded through metal back plate. (Refer to the list of tested MLPE devices on page XX of this manual).



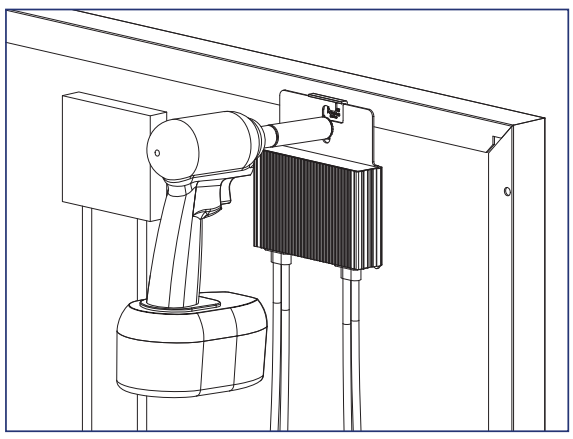
1) Slide the backplate channel of the MLPE device under the MLPE Frame Attachment Kit bolt. The MLPE mounting plate should rest against the MLPE mounting plate backstop on the MLPE Frame Attachment Kit.



2) Position the MLPE Frame Attachment Kit on the module frame flange in a location that will not interfere with mounting system components. The module frame flange should rest against the module flange backstop on the MLPE Frame Attachment Kit.

Install Note:

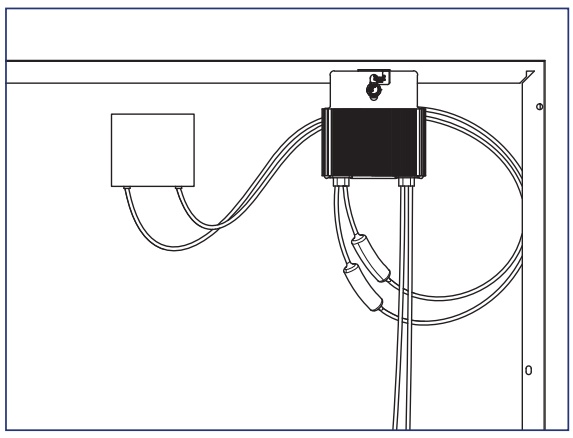
Avoid blocking module frame drainage holes when installing the MLPE Frame Attachment Kit.



3) Tighten the mounting bolt on the MLPE Frame Attachment Kit to 12 lb-ft (144 lb-in).

Install Note:

The MLPE Frame Attachment Kit bonds the following components: Module Frame, MLPE backplate and Smart Clip.



4) Connect the module leads to the input connectors on the MLPE device and manage conductors with the integrated Smart Clip.

MLPE & RSD Installation

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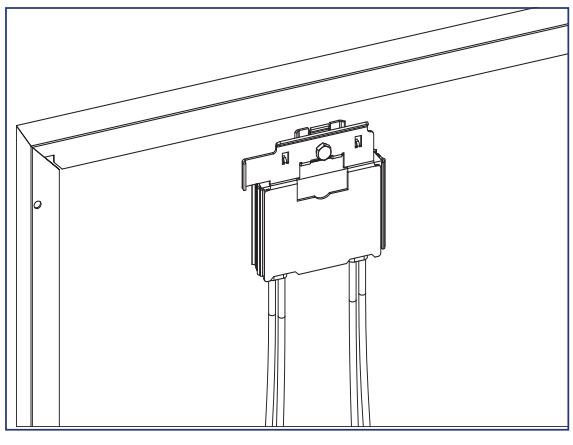
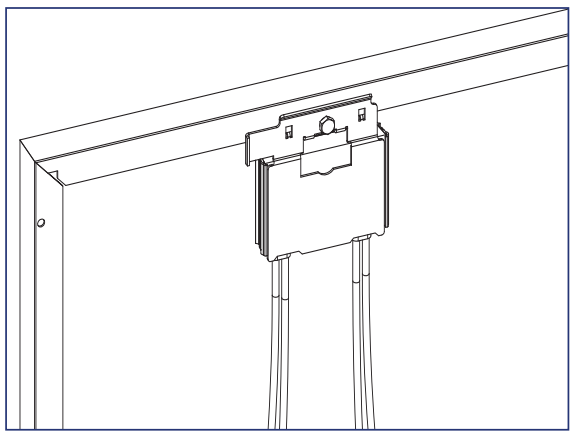
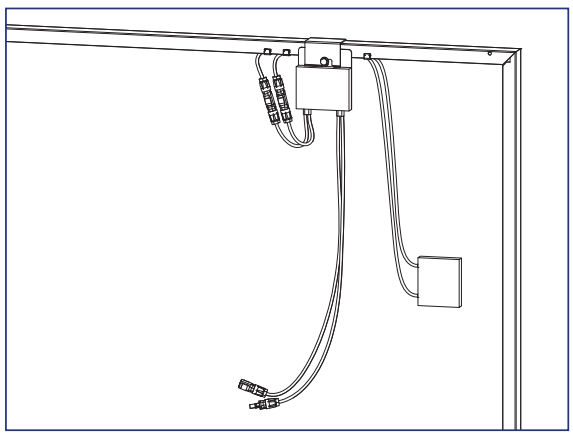
INSTALLATION INSTRUCTIONS - SOLAREDGE FRAME MOUNT



1) Locate the SolarEdge optimizer with Frame-Mounted Module Add-On at a location on the module frame that will not interfere with the TopSpeed™ Mounts.



2) Install the optimizer mounting plate onto the module frame and tighten hardware to 11 ft-lbs.

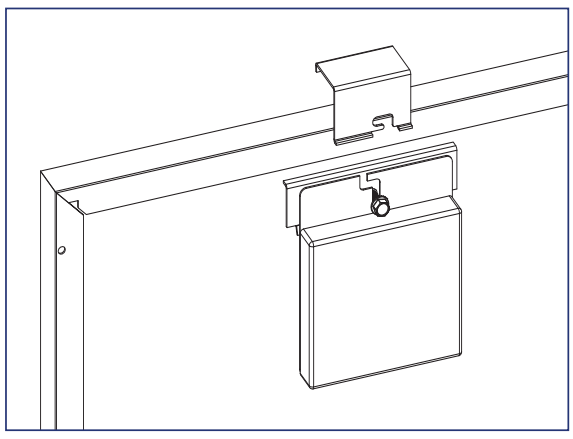


3) Connect the module leads to the input connectors on the optimizer and manage conductors with SnapNrack Smart Clips.

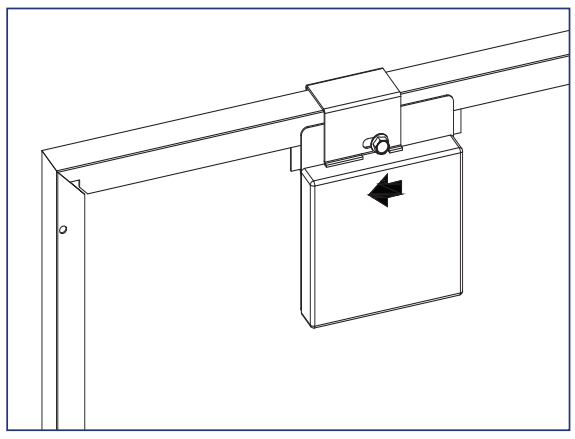
Install Note:

If module is mounted in portrait, install MLPE on long side, short side for landscape.

INSTALLATION INSTRUCTIONS - ENPHASE FRAME MOUNT



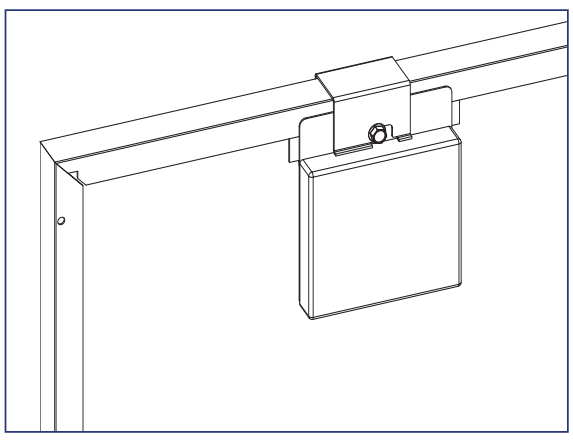
1) Locate the Enphase Frame Mount bracket clamp at a location on the module frame that will not interfere with the TopSpeed™ Mounts.



2) Slide the microinverter unit onto the bracket clamp, then move it slightly to the left.

Install Note:

The microinverter mounting flange should be on the outside of the module frame.



3) Tighten the hardware to 13 ft-lbs.

4) Connect module leads to microinverter DC connectors.

Install Note:

Refer to the Enphase Frame Mount installation guide for additional instructions.

Module Installation

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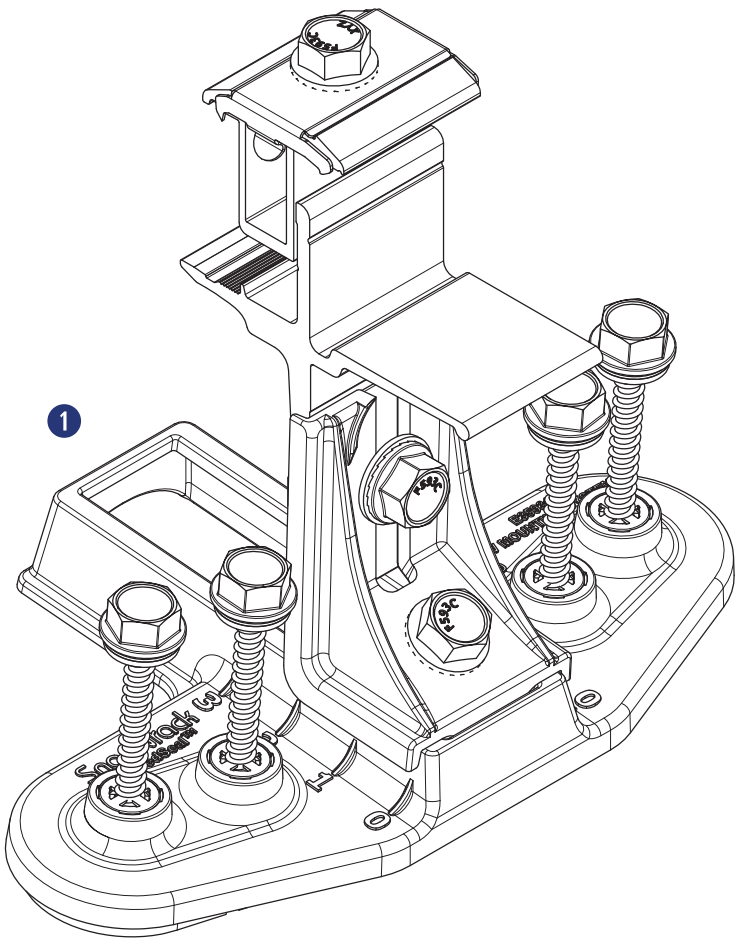
Required Tools

- Socket Wrench
- Torque Wrench
- 1/2” Socket
- Roofing Sealant

Materials Included

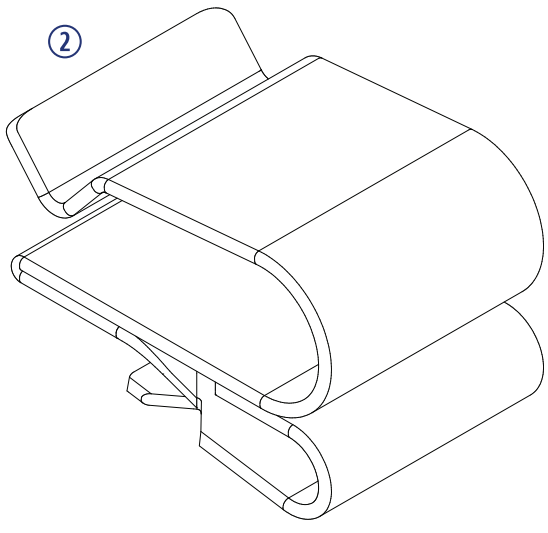
1. SnapNrack TopSpeed™ Mount
2. SnapNrack TopSpeed™ Clamp

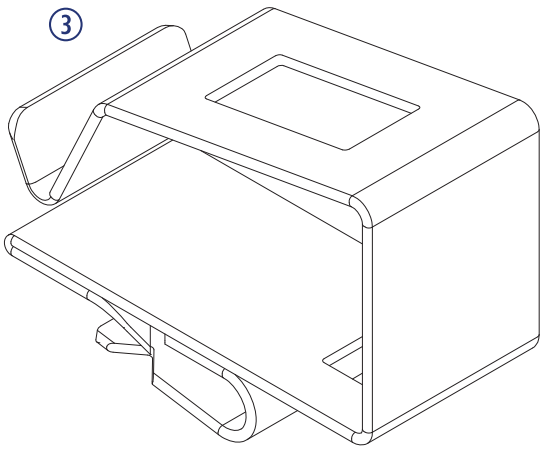


Other Materials Required

② **SnapNrack Smart Clip (2-5 per module)**
See Wire Management section for details

③ **SnapNrack Smart Clip XL (10-20 per array)**
See Wire Management section for details





Module Installation

INSTALLATION INSTRUCTIONS - BOTTOM ROW

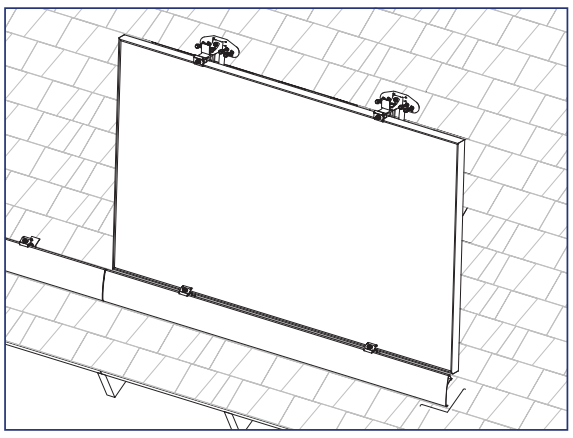
Recommended Best Practice:

Attach all TopSpeed™ mounts as the modules are being prepped with MLPEs on the ground. Attach Mounts before attaching MLPEs to simplify wire management.

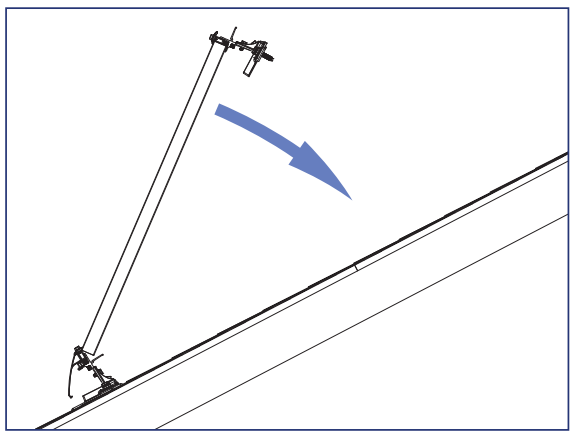
Install Note:

It is recommended that module leads and connectors are prepared for installation using SnapNrack Smart Clips before being brought to the rooftop.

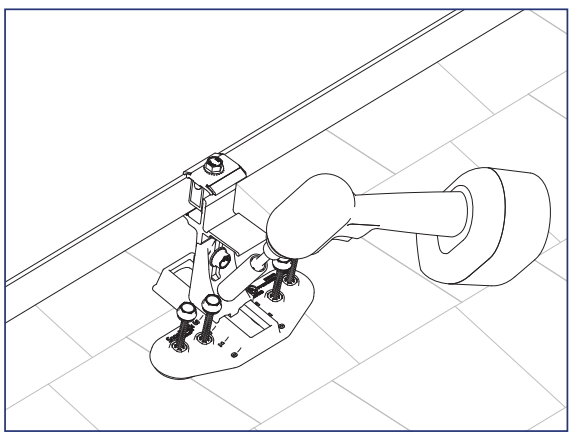
- With no MLPE, secure module leads to module frame to allow access to connectors while modules are installed
- Secure MLPE device to module frame with SnapNrack MLPE Frame Attachment Kit and connect module leads to MLPE, and manage leads by positioning connectors to allow access during installation

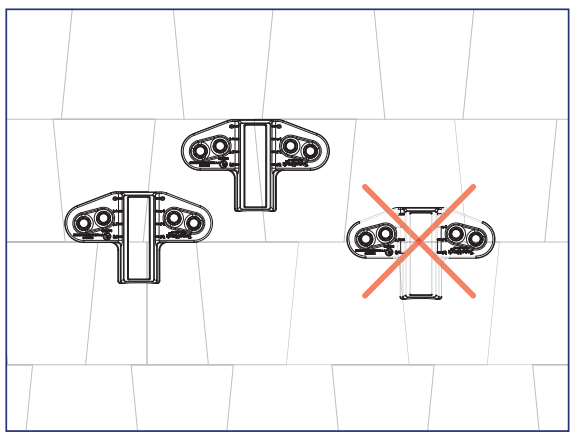


1) Rest downslope edge of module on the Mounts and/or Clamps position module so side edge is flush with marked edge of array layout or Skirt.

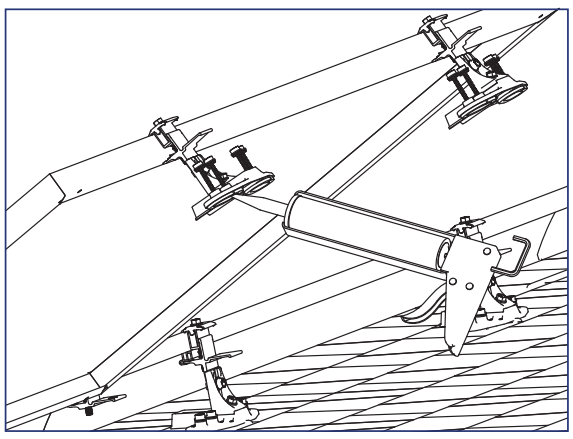


2) Lower upslope edge of module while simultaneously applying slight pressure to seat module into Mounts and/or Clamps.





3) When module is level with roof verify the Speedseal™ portion of the TopSpeed™ Mounts are positioned entirely on one course of composition. If required listen the 1/2″ nut and adjust the base as needed then tighten the bolt.

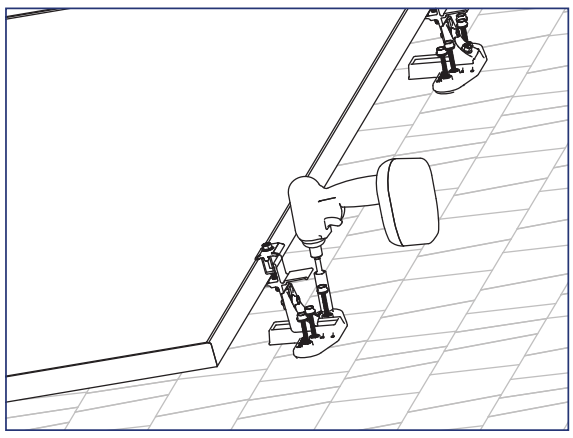


4) Lift the upslope edge of the module and fill the SpeedSeal™ reservoir with roofing sealant.

Install Note:

Roof sealant should be expelled from both vents of the TopSpeed™ Mount as it is installed to assure the proper amount of roof sealant has been applied. If sealant is not expelled from all four vents, remove TopSpeed™ Mount, add more sealant to the cavity, then reinstall.

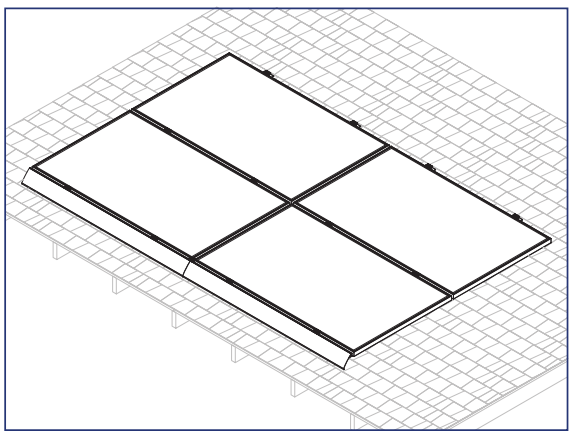
INSTALLATION INSTRUCTIONS - BOTTOM ROW



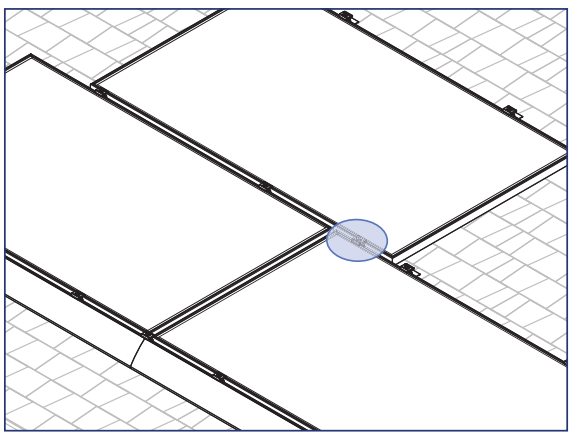
5) Lower the module to the roof and drive the (4) pre installed Snapnrack #14 Wood Screws with 1/2" hex head into the roof sheathing.

Install Note:

Roof sealant should be expelled from both vents of the TopSpeed™ Mount as it is installed to assure the proper amount of roof sealant has been applied. If sealant is not expelled from both vents, remove TopSpeed™ Mount, add more sealant to the cavity, then reinstall.



6) Repeat steps 1 through 5 for additional modules in the array.



7) For staggered arrays and arrays with mixed orientation, use the TopSpeed™ Clamp as needed to support the modules.

When installing a TopSpeed™ Clamp for support of an over cantilevered module, the clamp shall be installed 2-6” from the edge of the upslope (cantilevered) module.

Grounding Specifications

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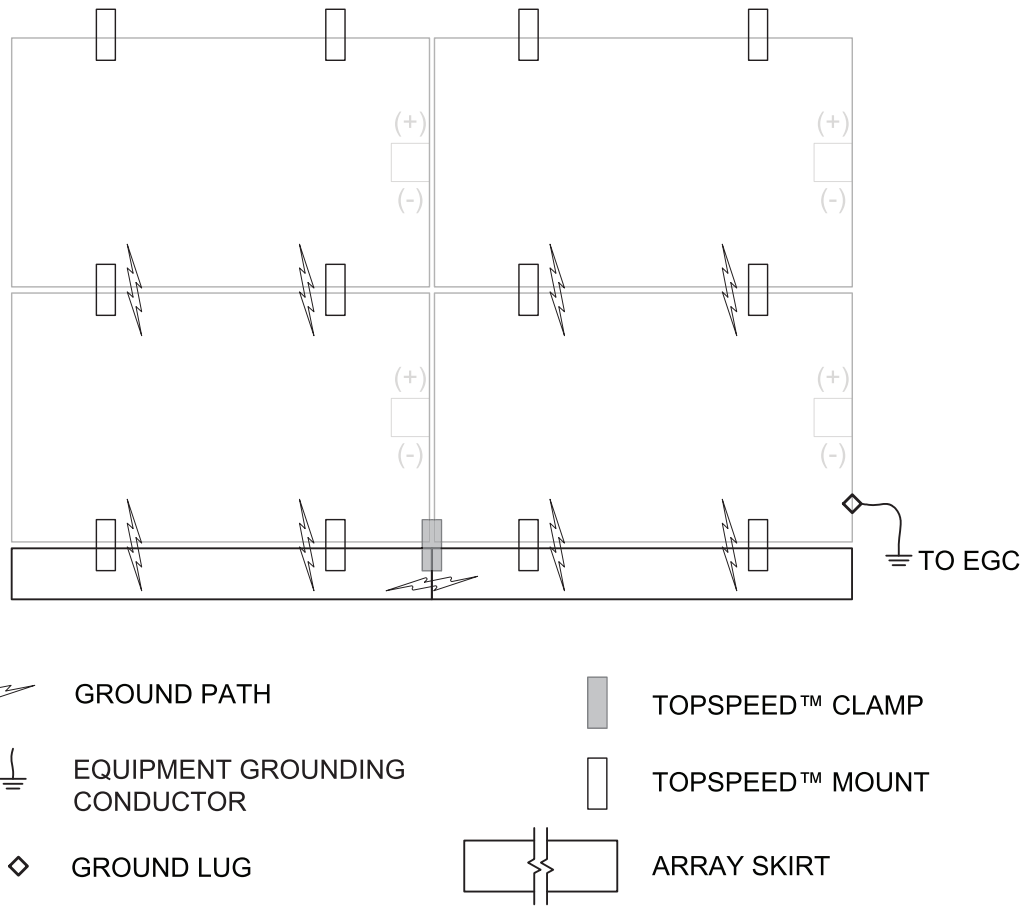
GROUND PATH DETAILS

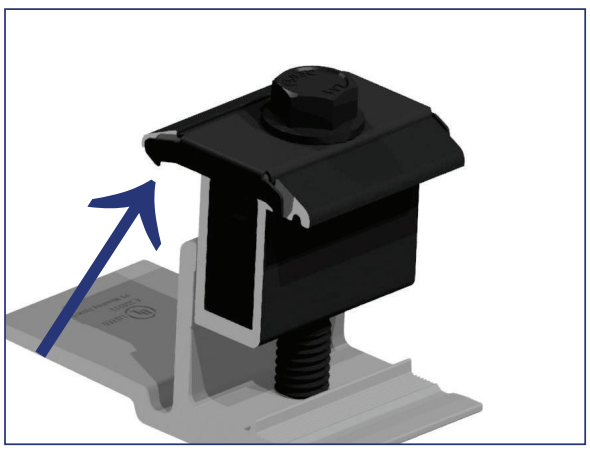
All TopSpeed™ components in the fault current ground path have been Certified to be used multiple times for grounding/bonding. The UL 2703 Listing does not specify a maximum number of uses for the Mount, Link, or Ground Lug. Review the requirements of the National Electrical Code (NEC) Article 250 to select the appropriate Equipment Grounding Conductor size based on the short-circuit current of the PV system.

When using Ground Lug R the following components are part of the fault current ground path:

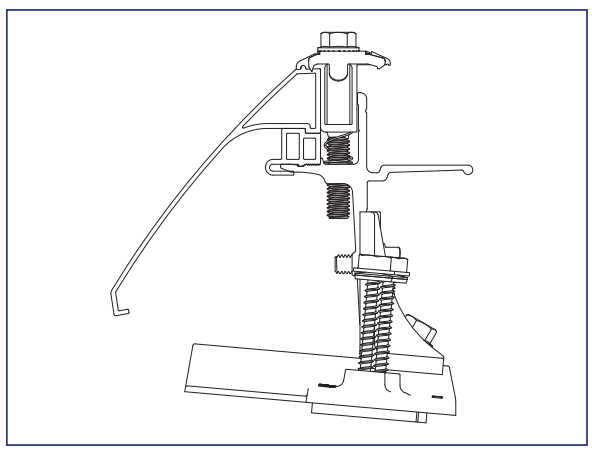
- SnapNrack, TopSpeed™ Mount
- SnapNrack, TopSpeed™ Clamp



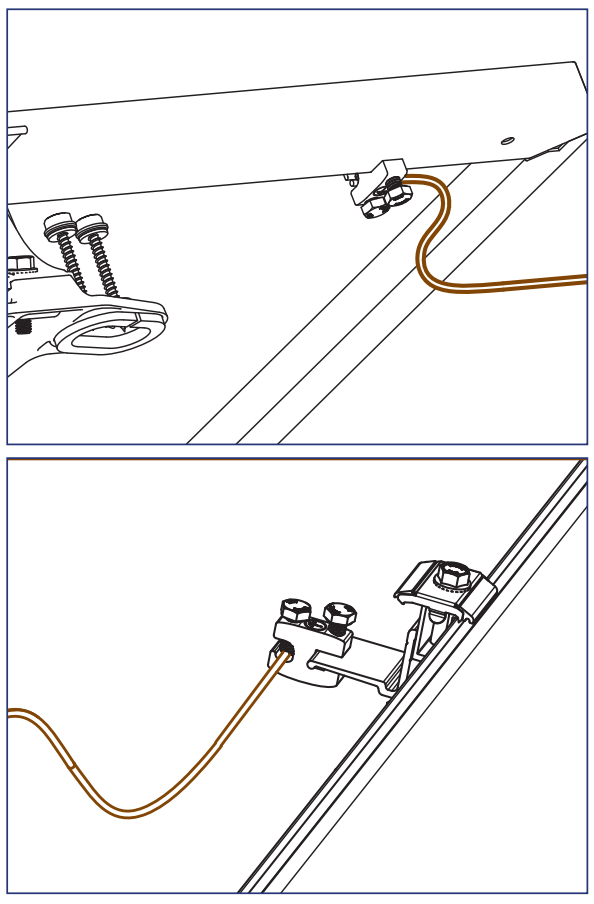
GROUNDING METHOD DETAILS



1) Row to row module bonding provided by bonding clips in Mount assembly and Clamp assembly.

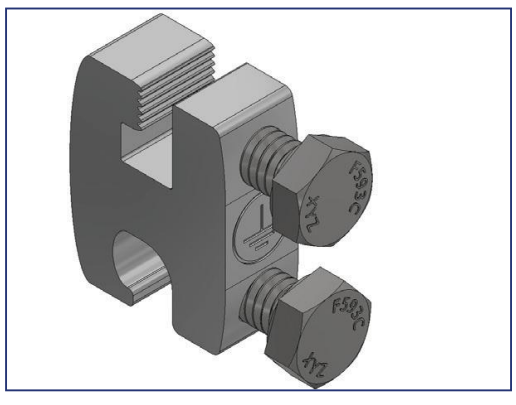


2) Column to column bonding provided by Universal Skirt and bonding clips in the Clamp assembly and/or the RL Universal Link assembly.
Module heights evaluated for bonding with Link Bonding Clamps: 40mm, 38mm, 35mm, 32mm, 30mm



3) Each continuous array is connected to Equipment Grounding Conductor through Ground Lug (242-92202) installed on one module per array.

Optionally; Install Ground Lug on the Mount Landing Pad at the top of the array.



GROUNDING MARKING DETAILS

The Ground Lug is marked with the ground symbol.

Maintaining the Grounding Bonding When Removing a Module

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INSTRUCTION FOR MAINTAINING THE GROUNDING BONDING WHEN REMOVING A MODULE FOR SERVICING

CAUTION: Module removal may disrupt the bonding path and could introduce the risk of electric shock. Additional steps may be required to maintain the bonding path. Modules should only be removed by qualified persons in compliance with the instructions in this manual.

Module removal is not presented as a frequently expected occurrence and will not be required as part of routine maintenance.

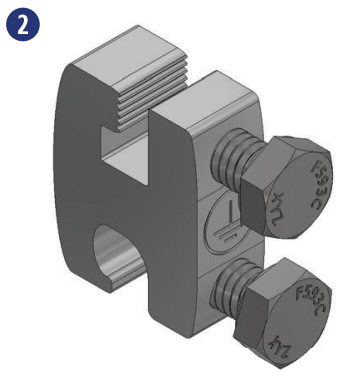
Scenarios that could result in a disruption of the bonding path are described, for example irregularly-shaped arrays, arrays consisting of individual rows, and any other scenario where module removal could disrupt the bonding path. In most cases, the removal of a module for servicing will not disturb or break grounding continuity. If a module is to be removed that will break continuity, these are the steps that must be taken to maintain a continuously bonded SnapNrack TopSpeed™ System.

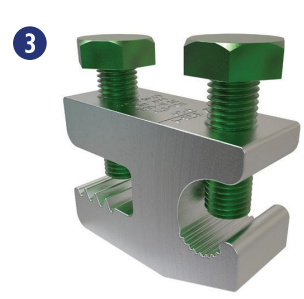
Required Tools

- Socket Wrench
- Torque Wrench
- 1/2” Socket
- 7/16” Socket

Required Materials

1. #10 Or Larger Bare Copper Conductor
2. SnapNrack Ground Lug part no. 242-92202
3. Ilsco Part No. SGB-4
4. DnoRaxx Dynobond™





Maintaining the Grounding Bonding When Removing a Module

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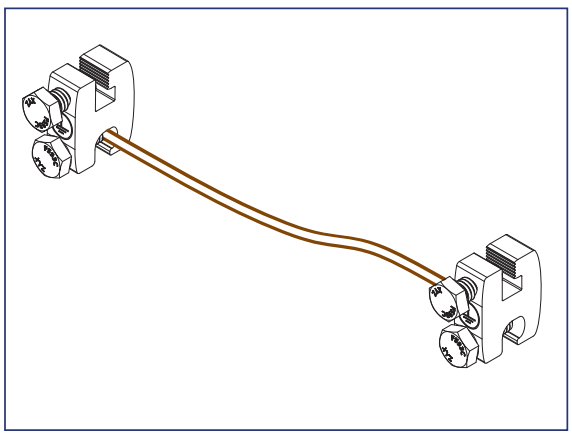
JUMPER ASSEMBLY INSTRUCTION & INSTALLATION

CAUTION: Do Not Remove the Module until the Jumper is installed

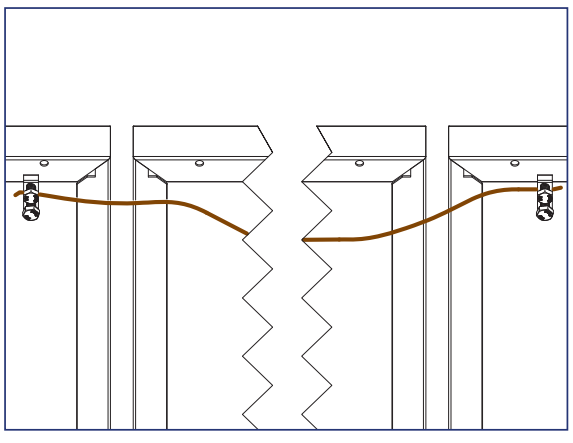
1) Identify the existing ground path at the location of module removal and choose an appropriate length of #10 bare copper to bridge the soon to be broken ground path.



Example of assembled bonding jumper using (2) SnapNrack Ground Lugs

2) Attach one ground lug to each end of #10 bare copper wire. See recommended options below:

1. (2) SnapNrack Ground Lug part no. 242-922022
2. (2) Ilsco part no. SGB-4
3. (1) DroRaxx DynoBond™



3) Before the module is removed, attach the assembled bonding jumper. Depending on where the module will be removed and choice of ground lug, jumper attachment locations will vary.

- SnapNrack Ground Lug part no. 242-92202 or Ilsco SGB-4 lugs can be attached to module frames or anywhere on the TopSpeed™ Mount.
- DynoRaxx DynoBond™ is approved and appropriate when a short bonding jumper is needed from module to module.

4) Service the array. With the bonding jumper installed, it is now safe to remove the module for service or maintenance.

5) After Servicing the array reinstall the module and original ground path. Only then Remove the bonding jumper.

Caution: Do not remove the bonding jumper until original ground path is established.

Appendix A

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APPROVED MODULE & MLPE INFORMATION

SnapNrack TopSpeed™ System has been tested with the following UL Listed module series: The SnapNrack TopSpeed™ System employs top-down clamps and links which have been evaluated for frame-to-system bonding, at specific mounting torques and with the specific module series listed below. All wattage values are covered.

Module manufacturer approval letters can be found at www.snapnrack.com.

Manufacturer	Model	
Aptos Solar	DNA-120-MF23-XXX	DNA-120-BF26-XXXW
	DNA-120-BF23-XXX	DNA-144-BF26-XXXW
	DNA-144-MF23-XXX	DNA-108-BF10-xxxW
	DNA-144-BF23-XXX	DNA-120-BF10-xxxW
	DNA-120-MF26-XXXW	DNA-108-MF10-xxxW
	DNA-144-MF26-XXXW	
Boviet Solar	BVM7612M-XXX-H-HC-BF-DG	
Canadian Solar	CS6K-XXX-M	CS1H-XXX-MS
	CS6K-XXX-M-SD	CS1H-XXX-MS-AB
	CS6K-XXX-P	CS3W-XXX-P
	CS6K-XXX-P-SD	CS3N-XXX-MS
	CS6K-XXX-MS	CS1Y-XXX-MS
	CS3K-XXX-P	CS3W-MB-AG
	CS3K-XXX-MS	CS3Y-MB-AG
	CS3U-XXX-MS	CS6W-XXXMB-AG
	CS3U-XXX-P	CS6R-XXXMS-HL
	CS1K-XXX-MS	CS3W-XXX-MS
CertainTeed	CTXXXHC11-06	
Chint Solar	CHSM6612M-XXX	CHSM72M-HC-XXX* (Astro 4)
	CHSM6612M(BL)-XXX	CHSM72M-HC-XXX* (Astro 5)
	CHSM6612M/HV-XXX	
Dehui Solar	DH-M760B-XXXW	DH-M760F-XXXW
	DH-M760W-XXXW	DH-M772F-XXXW
	DH-M772W-XXXW	
Freedom Forever	FF-MP-BBB-xxx	
Hanwha Q Cells	Q.PEAK DUO-G5-XXX	Q.PEAK DUO G10-XXX
	Q.PEAK DUO-BLK-G5-XXX	Q.PEAK DUO BLK G10-XXX
	Q.PLUS DUO-G5-XXX	Q.PEAK DUO G10+-XXX
	Q.PEAK DUO-G7-XXX	Q.PEAK DUO BLK G10+-XXX
	Q.PEAK DUO-BLK-G7-XXX	Q.PEAK DUO XL-G10.3-XXX
	Q.PEAK DUO-G7.2-XXX	Q.PEAK DUO XL-G10.c-XXX
	Q.PEAK DUO-G6+-XXX	Q.PEAK DUO XL-G10.d-XXX
	Q.PEAK DUO-BLK-G6+-XXX	Q.PEAK DUO L-G8.3/BFG-XXX
	Q.PEAK DUO-G6-XXX	Q.PEAK DUO L-G8.3/BGT-XXX
	Q.PEAK DUO-BLK-G6-XXX	Q.PEAK DUO ML-G10-XXX
	Q.PEAK DUO-G8+-XXX	Q.PEAK DUO BLK ML-G10+-XXX
	Q.PEAK DUO-BLK-G8+-XXX	Q.PEAK DUO ML-G10+-XXX

Appendix A

snapnrack.com

Manufacturer	Model	
Hanwha Q Cells	Q.PEAK DUO-G8-XXX	Q.PEAK DUO BLK ML-G10-XXX
	Q.PEAK DUO-BLK-G8-XXX	Q.PEAK DUO ML-G10.a+-XXX
	Q.PEAK DUO BLK-G6+/AC-XXX	Q.PEAK DUO BLK ML-G10.a+-XXX
	Q.PEAK DUO-ML-G9-XXX	Q.PEAK DUO ML-G10.a-XXX
	Q.PEAK DUO-BLK-ML-G9-XXX	Q.PEAK DUO BLK ML-G10.a-XXX
	Q.PEAK DUO-BLK-G9-XXX	Q.PEAK DUO BLK G10+/AC XXX
	Q.PEAK DUO-BLK-ML-G9+-XXX	Q.PEAK DUO BLK G10+/HL XXX
	Q.PEAK DUO-ML-G9+-XXX	Q.PEAK DUO BLK ML-G10+/t-XXX
	Q.PEAK DUO-BLK-ML-G9+-XXX	Q.PEAK DUO XL-G11.3 XXX
	Q.PEAK DUO XL-G9.2-XXX	Q.PEAK DUO XL-G11.3 BFG XXX
	Q.PEAK DUO XL-G9.3-XXX	Q.TRON-G1+ XXX
	Q.PEAK DUO XL-G9.3/BFG-XXX	Q.TRON BLK-G1+ XXX
	Q.PEAK DUO XL-G10.2-XXX	Q.TRON M-G2+ XXX
	Q.PEAK DUO XL-G10.3/BFG-XXX	Q.TRON BLK M-G2+ XXX
HT-SAAE	HT60-166M-XXX	HT60-182M-XXX
Heliene	60M-XXX	72M-XXX
	60P-XXX	72P-XXX
"Hyundai (All may be followed by “BK”)"	HiA-SXXXMS	HiS-SXXXYI
	HiS-SXXXXY	HiS-SXXXYH(BK)
	HiN-SxxxXG(BK)	
Hyperion/Runergy	HY-DH108P8-XXX(Y)	HY-DH144N8-XXX
	HY-DH144P8-XXX	HY-DH108N8-XXX
JA Solar	JAM60S09-XXX/PR	JAM72S10-XXX/PR
	JAM60S10-XXX/MR	JAM72S12-XXX/PR
	JAM60S10-XXX/PR	JAM60S17-XXX/MR
	JAM60S12-XXX/PR	JAM54S30-XXX/MR
	JAM72S09-XXX/PR	JAM54S31-XXX/MR
	JAM72S10-XXX/MR	JAM72D30-XXX/MB
Jinko Solar	JKMXXXM-60	JKMXXXP-72-V
	JKMXXXM-60L	JKMXXXPP-72
	JKMXXXM-60HL	JKMXXXPP-72-V
	JKMXXXM-60HBL	JKMSXXXP-72
	JKMXXXP-60	JKMXXXM-72HL-V
	JKMXXXP-60-J4	JKMXXXM-72HL-TV
	JKMXXXP-60-V	JKMXXXM-72HBL
	JKMXXXP-60B-J4	JKMXXXM-6TL3-B
	JKMXXXPP-60	JKMXXXM-6RL3-B
	JKMXXXPP-60-V	JKMXXXM-7RL3-V
	JKMXXXM-72	JKMXXXM-7RL3-TV
	JKMXXXM-72L-V	JKMXXXM-72HL4-V
	JKMXXXP-72	JKMXXXM-72HL4-TV
LG	LGXXXN1C-A5	LGXXXA1C-V5
	LGXXXN1K-A5	LGXXXM1C-L5
	LGXXXQ1C-A5	LGXXXM1K-L5
	LGXXXQ1K-A5	LGXXXN1C-N5

Appendix A

Manufacturer	Model	
LG	LGXXXS1C-A5	LGXXXN1K-L5
	LGXXXN2C-B3	LGXXXN1K-A6
	LGXXXN2W-B3	LGXXXN1C-A6
	LGXXXN1C-G4	LGXXXN1W-A6
	LGXXXN1K-G4	LGXXXQ1C-A6
	LGXXXS1C-G4	LGXXXQ1K-A6
	LGXXXN2C-G4	LGXXXM1K-A6
	LGXXXN2K-G4	LGXXXM1C-A6
	LGXXXN2W-G4	LGXXXA1C-A6
	LGXXXS2C-G4	LGXXXQAC-A6
	LGXXXS2W-G4	LGXXXQAK-A6
	LGXXXN1C-V5	LGXXXN1K-B6
	LGXXXN1W-V5	LGXXXN2W-E6
	LGXXXN2T-V5	LGXXXN2T-E6
	LGXXXN2T-J5	LGXXXN1K-E6
	LGXXXN1T-V5	LGXXXN3K-V6
Longi	LR6-60-XXXM	LR4-60HPB-XXXM
	LR6-60BK-XXXM	LR4-60HIB-XXXM
	LR6-60HV-XXXM	LR4-60HPH-XXXM
	LR6-60PB-XXXM	LR4-60HIH-XXXM
	LR6-60PE-XXXM	LR6-60HIH-XXXM
	LR6-60PH-XXXM	LR6-60HIB-XXXM
	LR6-60HPB-XXXM	LR4-72HPH-XXXM
	LR6-60HPH-XXXM	
Meyer Burger	Meyer Burger Black*	Meyer Burger White*
mSolar	TXI6-XXX120BB	
Mission Solar	MSEXXXSO5T	MSEXXXSQ4S
	MSEXXXSO5K	MSEXXXSR8K
	MSEXXXSQ5T	MSEXXXSR8T
	MSEXXXSQ5K	MSEXXXSR9S
	MSEXXXMM4J	MSE60AXXX
	MSEXXXMM4J	MSE60AXXX
	MSEXXXMM6J	MSEXXXSX5K
	MSEXXXSO6W	MSEXXXSX5T
	MSEXXXSO4J	MSEXXXSX6S
	MSEXXXSO6J	MSEXXXSX6W
	MSEXXXSQ6S	MSEXXXSX5R
Next Energy Alliance	USNEA-XXXM3-60	USNEA-XXXM3-72
	USNEA-XXXM3B-60	USNEA-XXXM3B-72
Panasonic	VBHNXXXKA03	VBHXXXRA18N
	VBHNXXXKA04	VBHXXXRA03K
	VBHNXXXSA17	EVPVXXX(K)
	VBHNXXXSA18	EVPVXXXH
	VBHN325SA17E	EVPVXXXPK

Appendix A

Manufacturer	Model	
Philadelphia Solar	PS-M144(HCBF)-XXXW	PS-M108(HC)-XXXW
	PS-M108(HCBF)-XXXW	
Phono Solar	PSXXXM-20/U	PSxxxM8GF-18/VH
	PSXXXMH-20/U	PSxxxM8GFH-18/VH
	PSxxxM8GF-24/TH	PSxxxM6-24/TH
	PSxxxM8GFH-24/TH	
REC (All may be followed by “BLK” or “BLACK”)	RECXXXTP2	RECXXXTP2SM 72 BLK2
	RECXXXTP2-BLK	RECXXXAA
	RECXXXNP	RECXXXTP3M
	RECXXXTP2M	RECXXXTP4
	RECXXXTP2M 72	RECXXXAA Pure
	RECXXXTP2M 72 BLK	RECXXXAA Pure-R
	RECXXXTP2M 72 BLK2	RECXXXNP2
	RECXXXTP2SM 72	RECXXXNP3
	RECXXXTP2SM 72 BLK	
SEG Solar	SEG-400-BMB-HV	SEG-xxx-BMD-HV
	SEG-400-BMB-TB	SEG-xxx-BMD-TB
Silfab	SLAXXX-M	SILXXXNT
	SLAXXX-P	SILXXXHL
	SSAXXX-M	SILXXXBK
	SSAXXX-P	SILXXXNX
	SILXXXBL	SILXXXNU
	SILXXXML	SILXXXHC
	SILXXXNL	SILXXXHN
	SLGXXX-M	SILXXXBG
	SLGXXX-P	SIL-xxxHC+
	SSGXXX-M	SIL-xxxHM
	SSGXXX-P	
Solaria	Solaria PowerXT-XXXR-PX	Solaria PowerXT-XXXR-PM
	Solaria PowerXT-XXXR-BX	Solaria PowerXT-XXXR-PM-AC
	Solaria PowerXT-XXXR-AC	
Sunpower	SPR-AXXX-G-AC	SPR-MXXX-H-AC
	SPR-AXXX	SPR-MXXX
	SPR-AXXX-BLK-G-AC	SPR-MXXX-BLK-H-AC
	SPR-AXXX-BLK	SPR-MXXX-BLK
SunSpark	SST-XXXM3-60	SST-XXXM3-72
	SST-XXXM3B-60	SST-XXXM3B-72
Talesun	TP660M-XXX	TP672M-XXX
	TP660P-XXX	TP672P-XXX
Thornova	TS-BB54(XXX)	TS-BG60(XXX)
	TS-BB60(XXX)	TS-BG72(XXX)
	TS-BG54(XXX)	

Appendix A

Manufacturer	Model	
Trina	TSM-XXXDD05(II)	TSMXXXDD05H.05(II)
	TSM-XXXDD05A.05(II)	TSM-XXXDD06M.05(II)
	TSM-XXXDD05A.08(II)	TSM-XXXDE15H(II)
	TSM-XXXDD05A.082(II)	TSM-XXXDE15M(II)
	TSM-XXXPA05	TSMXXXDE06X.05(II)
	TSM-XXXPA05.05	TSMXXXDE09.05
	TSM-XXXPA05.08	TSM-XXXDE15V(II)
	TSM-XXXPD05	TSM-XXXDEG15VC.20(II)
	TSM-XXXPD05.002	TSM-XXXDEG18MC.20(II)
	TSM-XXXPD05.05	TSM-XXXDEG19C.20
	TSM-XXXPD05.05S	TSM-XXXDEG21C.20
	TSM-XXXPD05.08	TSM-XXXDE09C.05
	TSM-XXXPD05.082	TSM-XXXDE09C.07
	TSM-XXXPD05.08D	TSM-xxxNE09RC.05
	TSM-XXXPD05.08S	
Vikram Solar	SOMERA VSMHBB.60.XXX.05	PREXOS VSMDHT.60.XXX.05
	SOMERA VSMH.72.XXX.05	PREXOS VSMDHT.72.XXX.05
VSUN	VSUNXXX-144BMH-DG	VSUNXXX-108BMH
	VSUNXXX-120BMH	
ZNShine	ZXM6-60-XXX/M	ZXM6-NH144-XXXM
	ZXM6-NH120-XXXM	ZXM7-SH108-XXXM
	ZXM7-SHLDD144-XXXM	

SnapNrack TopSpeed™ has been tested with the following Module Level Power Electronic (MLPE) devices:

SnapNrack TopSpeed™ mounting systems has been tested with the following UL/NRTL Listed Module Level Power Electronic (MLPE) Devices. The back plates of the MLPEs have been evaluated for bonding to TopSpeed™ through the SnapNrack MLPE Frame Attachment Kit, model 242-02151.

MLPE Manufacturer	Model	
AP Smart	RSD-S-PLC	
Celestica International	DG-006-F001201x	DG-006-F001401x
Delta Electronics	GPI00010105	
Enphase	C250	IQ7PLUS-72-2-US
	M215	IQ7PLUS-72-B-US
	M250	IQ8-60
	IQ6-60-2-US	IQ8PLUS-72
	IQ6PLUS-72-2-US	IQ8A-72
	IQ7-60-2-US	IQ8H-208-72
	IQ7-60-B-US	IQ8H-240-72
Generec	S2502	
Ginlong Technologies	Solis-RSD-1G	
	Solis-MLRSD-R1-1G	Solis-MLRSD-R2-1G

Appendix A

MLPE Manufacturer	Model	
SolarEdge	P300-5NC4ARS	P320-5NC4ARS
	P370-5NC4AFS	P400-5NC4AFS
	P320	P340
	P370	P400
	P401	P405
	P485	P505
	P730	P800p
	P850	P860
	P950	P1100
	P1101	S440
	S500	
SMA	RSB-2S-US-10	
Tigo	TS4-R-F	TS4-R-M
	TS4-R-O	TS4-R-S
	TS4-R-M-DUO	TS4-R-O-DUO
	TS4-R-S-DUO	TS4-A-F
	TS4-A-2F	TS4-A-O
	TS4-A-S	

UL Product iQ®

Mounting Systems, Mounting Devices, Clamping Devices and Ground Lugs for Use with Photovoltaic Modules and Panels

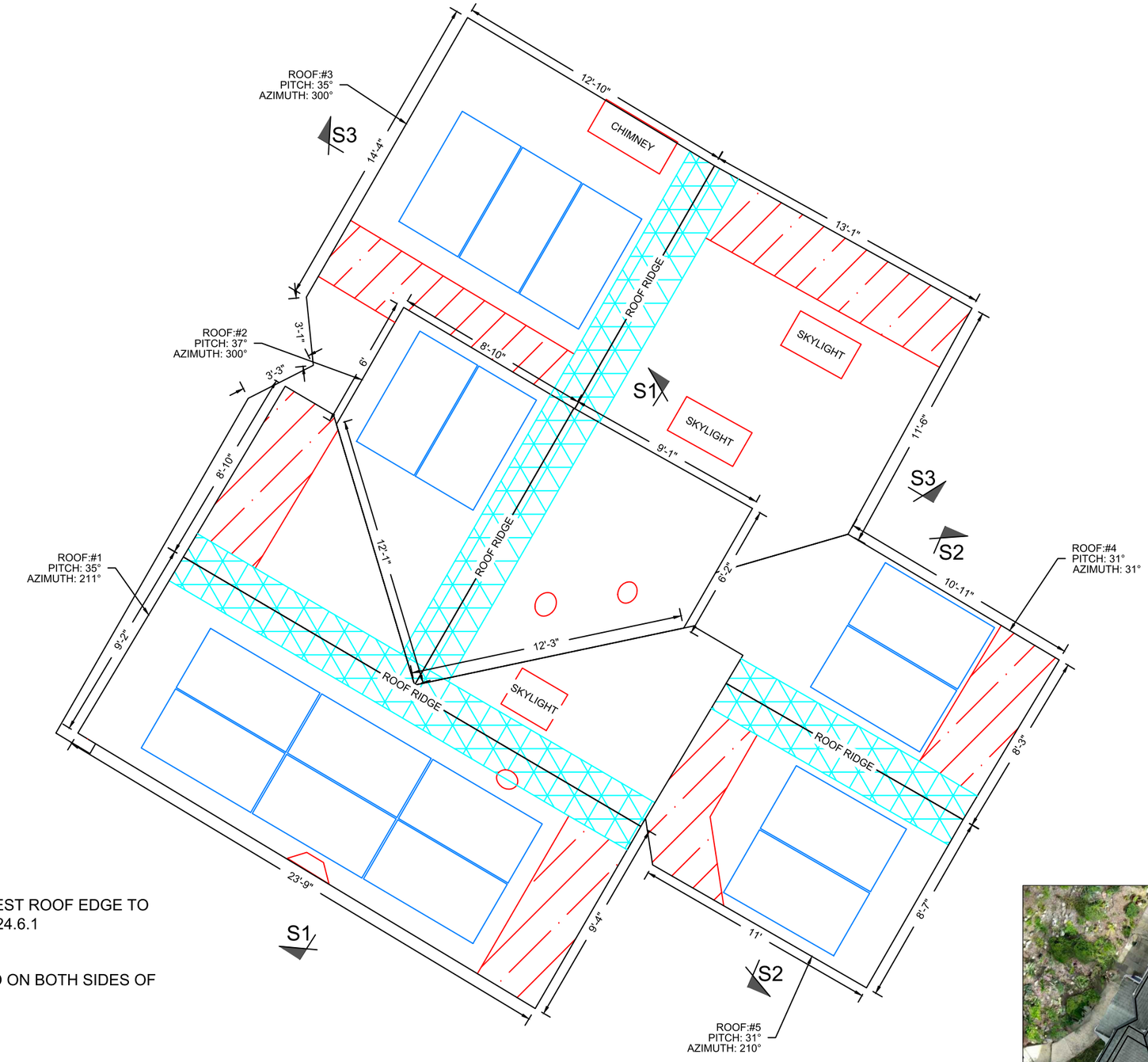
COMPANY

SUNRUN SOUTH LLC, DBA SNAPNRACK
775 Fiero Ln
Suite 200
San Luis Obispo, CA 93401 United States

E359313

Cat. No.	Investigated for Bonding	Investigated for Mechanical Loading	System Fire Classification (A, B or C)	Tested in Combination With
Photovoltaic mounting system				

Critter Guard



N

S

KEY

FIRE SAFETY ZONE

3' PATHWAYS FROM LOWEST ROOF EDGE TO RIDGE PROVIDED PER R324.6.1

1'6" PATHWAYS PROVIDED ON BOTH SIDES OF RIDGE PER R324.6.2

PLAN VIEW TOTAL ROOF AREA: 1416 SQFT

SOLAR ARRAY AREA: 315.00 SQFT

THE SOLAR ARRAY IS 22.2% OF THE PLAN VIEW TOTAL ROOF AREA

NOTES:

1. THE SYSTEM SHALL INCLUDE (15) HANWHA Q.TRON BLK M-G2+ 435W.
2. SNAPNRACK TOPSPEED WILL BE INSTALLED IN ACCORDANCE WITH SNAPNRACK INSTALLATION MANUAL.
3. REFER TO STRUCTURAL DRAWING FOR SECTIONS MARKED AND ADDITIONAL NOTES.

SOLAR PANEL LAYOUT

Scale: 3/16" = 1'-0"

STATE OF MARYLAND
DAVID C. HERNANDEZ
4999
PROFESSIONAL ENGINEER

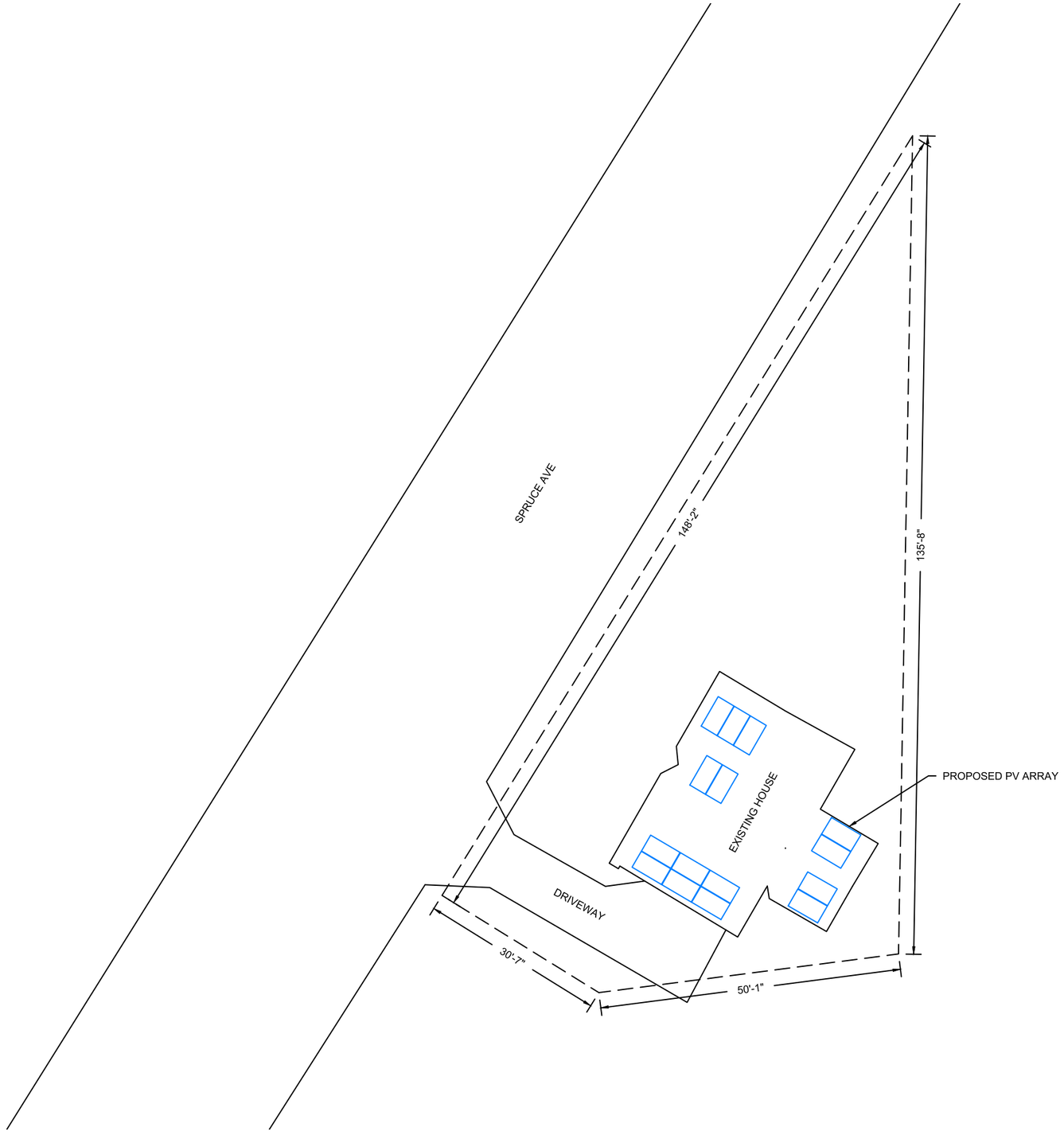
PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 49993 EXP 10/06/2026

David C. Hernandez, PE
Digitally signed by David C. Hernandez, PE
Date: 2025.07.24 20:02:05 -04:00

SolarEnergyWorld
Because Tomorrow Matters

Solar Energy World LLC.
14880 Sweitzer Lane
Laurel, MD 20707
(888) 497-3233

Building Code	International Residential Code (IRC) 2021
Electrical Code	National Electrical Code (NEC) 2023
Wind Speed	115 MPH
Snow Load	30 PSF
Modules	(15) HANWHA Q.TRON BLK M-G2+ 435W
Inverter(s)	(15) IQ8MC-72-M-US
DC System Size	6.525 kW
AC System Size	4.800 kW
Customer Information	Jennifer Airoldi 7221 Spruce Ave Takoma Park, MD 20912
Partner/Lender	None
AHJ	Montgomery
Utility	Pepco
Sheet Name	Solar Panel Layout
Drawn By	CB
Date	July 24, 2025
Scale	AS NOTED
Job Number	MD26539
Sheet	A-1



N

S

SITE PLAN

Scale: 1" = 20'-0"

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 49993 EXP 10/06/2026

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Laurel, MD 20707
(888) 497-3233

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Wind Speed	115 MPH
Snow Load	30 PSF
Modules	(15) HANWHA Q.TRON BLK M-G2+ 435W
Inverter(s)	(15) IQ8MC-72-M-US
DC System Size	6.525 kW
AC System Size	4.800 kW
Customer Information	Jennifer Airoldi 7221 Spruce Ave Takoma Park, MD 20912
Partner/Lender	None
AHJ	Montgomery
Utility	Pepco
Sheet Name	Site Plan
Drawn By	CB
Date	July 24, 2025
Scale	AS NOTED
Job Number	MD26539
Sheet	A-2

EQUIPMENT LOCATION PLAN

Scale: NTS

NOTE:

EQUIPMENT LOCATION PLAN IS APPROXIMATE, EXACT LOCATION TO BE VERIFIED WITH INSTALLATION CREW AND HOME OWNER AT THE TIME OF INSTALLATION.

STATE OF MARYLAND
DAVID C. HERNANDEZ
49993
PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 49993 EXP 10/06/2026

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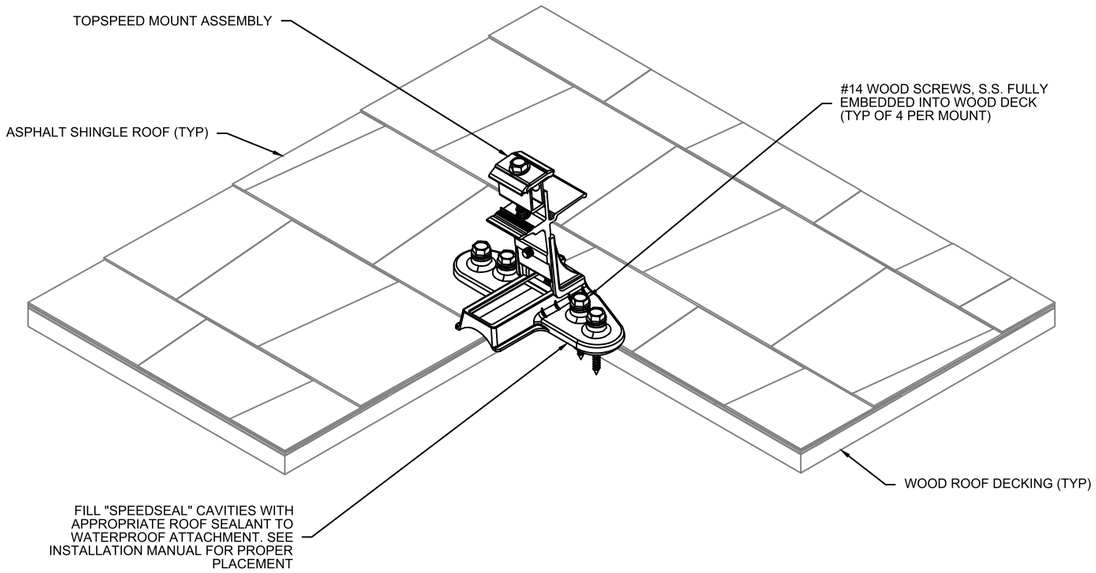
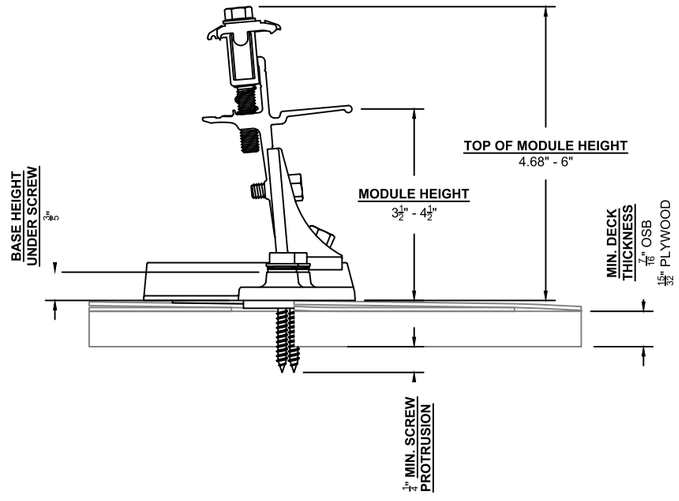
Date: 2025.07.24 20:02:05 -04:00

SolarEnergyWorld
Because Tomorrow Matters

Solar Energy World LLC.
14880 Sweitzer Lane
Laurel, MD 20707
(888) 497-3233

Building Code	International Residential Code (IRC) 2021
Electrical Code	National Electrical Code (NEC) 2023
Wind Speed	115 MPH
Snow Load	30 PSF
Modules	(15) HANWHA Q.TRON BLK M-G2+ 435W
Inverter(s)	(15) IQ8MC-72-M-US
DC System Size	6.525 kW
AC System Size	4.800 kW
Customer Information	Jennifer Airoldi 7221 Spruce Ave Takoma Park, MD 20912
Partner/Lender	None
AHJ	Montgomery
Utility	Pepco
Sheet Name	Equipment Location Plan
Drawn By	CB
Date	July 24, 2025
Scale	AS NOTED
Job Number	MD26539
Sheet	E-1





STRUCTURAL ATTACHMENT DETAIL

Structural Details		
S1	Rafter	2x8 O.C. 24"
S2	Rafter	2x8 O.C. 16"
S3	Rafter	2x6 O.C. 24"

NOTES:

1. ALL WORK SHALL COMPLY WITH REQUIREMENTS OF INTERNATIONAL RESIDENTIAL CODE (IRC 2021), LOADING CODE (ASCE 7-16), WOOD DESIGN CODE (NDS 2015), AND LOCAL REQUIREMENTS.
2. LOAD CRITERIA PER :
   - EXPOSURE CATEGORY "B"
   - GROUND SNOW LOAD, Pg = 30 PSF
   - LATERAL LOAD RISK CATEGORY "II"
   - ULTIMATE DESIGN WIND SPEED = 115 MPH
3. SOLAR PANELS AND RACKING SYSTEMS SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATION.
4. FOLLOW ALL LOCAL AND FEDERAL SAFETY REQUIREMENTS.

STATE OF MARYLAND
DAVID C. HERNANDEZ
4993
PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 49993 EXP 10/06/2026

David C. Hernandez, PE
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Date: 2025.07.24 20:02:05 -04:00

SolarEnergyWorld
Because Tomorrow Matters

Solar Energy World LLC.
14880 Sweitzer Lane
Laurel, MD 20707
(888) 497-3233

Building Code: International Residential Code (IRC) 2021

Electrical Code: National Electrical Code (NEC) 2023

Wind Speed: 115 MPH | Snow Load: 30 PSF

Modules: (15) HANWHA Q.TRON BLK M-G2+ 435W

Inverter(s): (15) IQ8MC-72-M-US

DC System Size: 6.525 kW | AC System Size: 4.800 kW

Customer Information:
Jennifer Airoldi
7221 Spruce Ave
Takoma Park, MD 20912

Partner/Lender: None

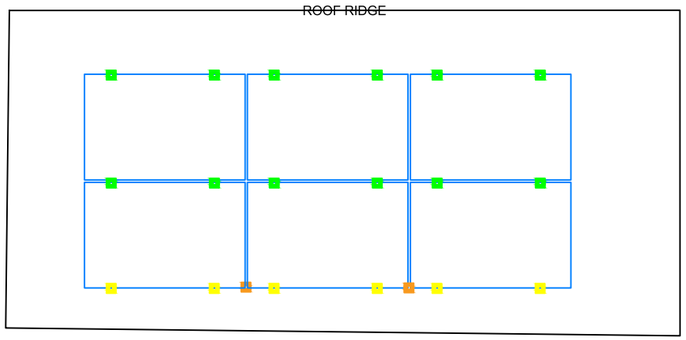
AHJ: Montgomery | Utility: Pepco

Sheet Name: Structural Attachment Details

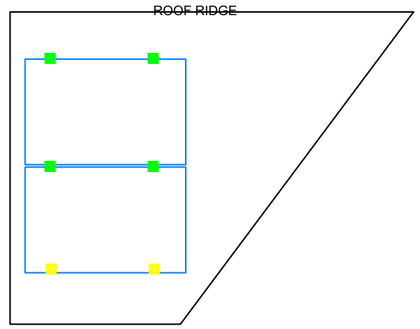
Drawn By: CB | Date: July 24, 2025

Scale: AS NOTED | Job Number: MD26539 | Sheet: S-1

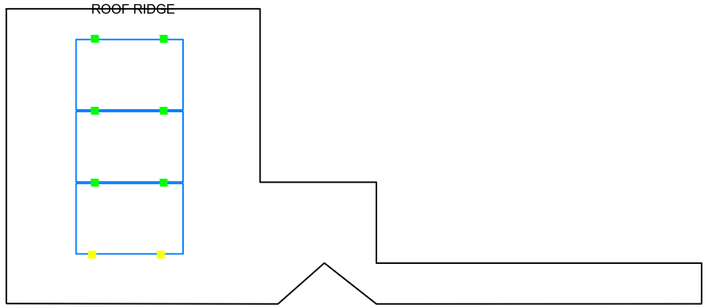
Bill Of Materials	
Product	Count
Mounts Without Spacers	30
Mounts With Spacers	14
Clamps Without Spacers	0
Clamps With Spacers	2



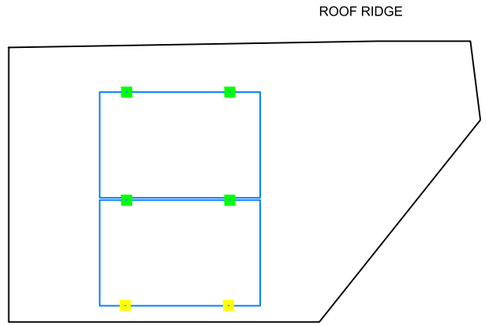
SOLAR PANEL FOOTING PLAN R1
Scale: 3/16" = 1'-0"



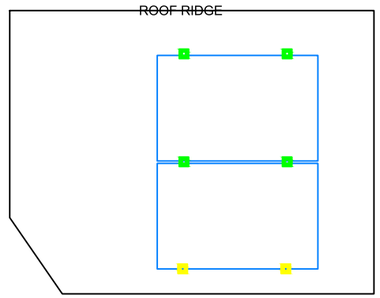
SOLAR PANEL FOOTING PLAN R1
Scale: 3/16" = 1'-0"



SOLAR PANEL FOOTING PLAN R3
Scale: 1/8" = 1'-0"



SOLAR PANEL FOOTING PLAN R4
Scale: 3/16" = 1'-0"



SOLAR PANEL FOOTING PLAN R5
Scale: 3/16" = 1'-0"

KEY

- MOUNTS WITHOUT SPACERS
- MOUNTS WITH SPACERS
- CLAMPS WITHOUT SPACERS
- CLAMPS WITH SPACERS

NOTES:

1. SNAPNRACK TOPSPEED SHALL BE INSTALLED IN ACCORDANCE WITH SNAPNRACK INSTALLATION MANUAL.
2. ADD TOPSPEED CLAMP IF GREATER THAN (SOLAR PANEL LENGTH / 4) FOR LANDSCAPE OR (SOLAR PANEL WIDTH /4) FOR PORTRAIT
3. NO SOLAR PANEL SHALL CANTILEVER MORE THAN 1/4 SOLAR PANEL LENGTH OR WIDTH DEPENDING ON ORIENTATION. UNLESS FOR MANUFACTURER SPECIFIED CLAMPING ZONE

STATE OF MARYLAND
DAVID C. HERNANDEZ
21993
PROFESSIONAL ENGINEER

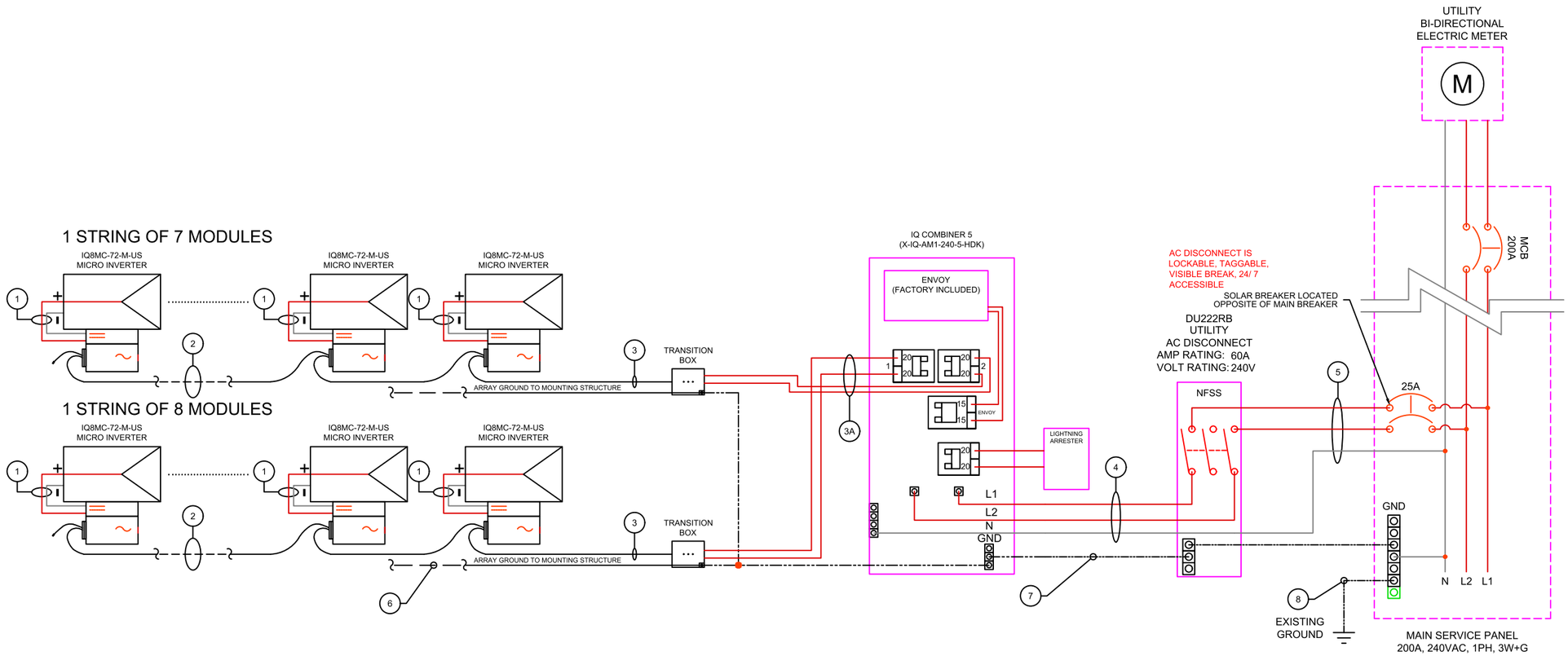
PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 21993, EXP 10/06/2026

David C. Hernandez, PE
Digitally signed by David C. Hernandez, PE
Date: 2025.07.24 20:02:05 -04:00

SolarEnergyWorld
Because Tomorrow Matters

Solar Energy World LLC.
14880 Sweitzer Lane
Laurel, MD 20707
(888) 497-3233

Building Code: International Residential Code (IRC) 2021
Electrical Code: National Electrical Code (NEC) 2023
Wind Speed: 115 MPH | Snow Load: 30 PSF
Modules: (15) HANWHA Q.TRON BLK M-G2+ 435W
Inverter(s): (15) IQ8MC-72-M-US
DC System Size: 6.525 kW | AC System Size: 4.800 kW
Customer Information: Jennifer Airoldi, 7221 Spruce Ave, Takoma Park, MD 20912
Partner/Lender: None
AHJ: Montgomery | Utility: Pepco
Sheet Name: Solar Panel Footing Plan
Drawn By: CB | Date: July 24, 2025
Scale: AS NOTED | Job Number: MD26539 | Sheet: S-2



MODULE SPECIFICATIONS		
MODEL NUMBER	QTRON BLK M-G2+ 435W	
PEAK POWER	435 W	
RATED VOLTAGE (Vmpp)	33.33 V	
RATED CURRENT (Imp)	13.12 A	
OPEN CIRCUIT VOLTAGE (Voc)	39.60 V	
SHORT CIRCUIT CURRENT (Isc)	13.82 A	
MAXIMUM SYSTEM VOLTAGE	1000VDC	
INVERTER SPECIFICATIONS		
MODEL NUMBER	IQ8MC-72-M-US	
MAXIMUM DC VOLTAGE	60 V	
MAXIMUM POWER OUTPUT	320 W	
NOMINAL AC VOLTAGE	240 VAC	
MAXIMUM AC CURRENT	1.33 A	
CEC EFFICIENCY	97.0%	
ARRAY DETAILS		
NO. OF MODULES PER STRING	7	8
NO. OF STRINGS	1	1
ARRAY WATTS AT STC	3045	3480

3-LINE DIAGRAM

WIRE/CONDUIT SCHEDULE ARRAY			
TAG	DESCRIPTION	WIRE SIZE/TYPE	NOTES
1	Panel to Micro Inverter	PV Wire (Factory Made)	INTEGRATED
2	Micro Inverter to Micro Inverter	Pre-Manufactured Cable	
3	Micro Inverter to Transition Box	Pre-Manufactured Cable	
3A	Transition Box to Load Center	#10 THHN/THWN-2	INTEGRATED
4	Load Center to AC Disconnect	#10 Cu THHN/THWN-2	
5	AC Disconnect to Interconnection Point	#10 Cu THHN/THWN-2	
6	Equipment Grounding Conductor	#8 Cu Bare Copper Wire	
7	Equipment Grounding Conductor	#8 Cu THHN/THWN-2	
8	Grounding Electrode Conductor	#6 Cu	

GENERAL ELECTRIC NOTES: NEC2023

1. EQUIPMENT USED SHALL BE NEW, UNLESS OTHERWISE NOTED.
2. EQUIPMENT USED SHALL BE UL LISTED, UNLESS OTHERWISE NOTED.
3. EQUIPMENT SHALL BE INSTALLED PROVIDING ADEQUATE PHYSICAL WORKING SPACE AROUND THE EQUIPMENT AND SHALL COMPLY WITH NEC.
4. COPPER CONDUCTORS SHALL BE USED AND SHALL HAVE AN INSULATION RATING OF 600V, 90°C, UNLESS OTHERWISE NOTED
5. CONDUCTORS SHALL BE SIZED IN ACCORDANCE TO THE NEC. CONDUCTORS AMPACITY SHALL BE DE-RATED FOR TEMPERATURE INCREASE, CONDUIT FILL AND VOLTAGE DROP.
6. ALL CONDUCTORS, EXCEPT PV WIRE SHALL BE INSTALLED IN APPROVED CONDUITS OR RACEWAY. CONDUITS SHALL BE ADEQUATELY SUPPORTED AS PER NEC.
7. AC DISCONNECT SHOWN IS REQUIRED IF THE UTILITY REQUIRES VISIBLE-BLADE SWITCH.
8. EXPOSED NON-CURRENT CARRYING METAL PARTS SHALL BE GROUNDED AS PER NEC.
9. LINE SIDE INTER-CONNECTION SHALL COMPLY WITH NEC.
10. SMS MONITORING SYSTEM AND IT'S CONNECTION SHOWN IS OPTIONAL. IF USED, REFER TO SMS INSTALLATION MANUAL FOR WIRING METHODS AND OPERATION PROCEDURE.
11. ASHRAE FUNDAMENTAL OUTDOOR DESIGN TEMPERATURES DO NOT EXCEED 47°C IN THE U.S. (PHOENIX, AZ OR PALM SPRINGS, CA)
12. FOR LESS THAN 9 CURRENT-CARRYING CONDUCTORS IN ROOF MOUNTED SUNLIGHT CONDUIT USING THE OUTDOOR TEMPERATURE OF 47°C
    12.1. 10AWG CONDUCTOR ARE GENERALLY ACCEPTABLE FOR MODULES WITH AN Isc OF 9.6 AMPS WITH A 15 AMP FUSE.

WIRE SIZING FOR OCPD
EX (Isc *(1.25)(1.25)(# OF STRINGS IN PARALLEL) = WIRE AMPACITY OR USING NEC TABLE 690.8

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