MONTGOMERY COUNTY HISTORIC PRESERVATION COMMISSION
STAFF REPORT

Address:	7112 Sycamore Ave., Takoma Park	**Meeting Date:**	5/9/18
Resource:	Contributing Resource **Takoma Park Historic District**	**Report Date:**	5/2/18
Applicant:	Thomas LaLonde	**Public Notice:**	4/25/18
Review:	HAWP	**Tax Credit:**	n/a
Case Number:	37/03-18HH	**Staff:**	Dan Bruechert
Proposal:	Roof Solar Panel Installation		

STAFF RECOMMENDATION

Staff recommends the HPC **approve with one (1) condition** the HAWP application.

1. The proposed location of the inverter box is too prominent. The inverter box must be installed below the level of the window sills on the north wall and any additional electrical conduit needs to be painted to match the historic house.

ARCHITECTURAL DESCRIPTION

SIGNIFICANCE:	Contributing to the Takoma Park Historic District
STYLE:	Craftsman
DATE:	c.1910

The subject property is a one-and-a-half story Craftsman bungalow with a three-tab asphalt-shingled side gable roof and prominent shed dormer. The house is two bays wide with a full-width porch covered by the gable porch overhang. The house is clad in stucco with shingle siding on the shed dormer and under the gables on the upper floor.

Figure 1: 7112 Sycamore

PROPOSAL

The applicant proposes to install 32 roof-mounted solar panels on the front and rear shed dormers.

APPLICABLE GUIDELINES

When reviewing alterations and new construction within the Takoma Park Historic District several documents are to be utilized as guidelines to assist the Commission in developing their decision. 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*). The pertinent information in these documents is outlined below.

Takoma Park Historic District Design Guidelines

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

> 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 (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 district.

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 way-of-way which involve the replacement of or damaged to original ornamental or architectural features are discouraged, but may be considered and approved on a case-by-case basis
>
> Some non-original building materials may be acceptable on a case-by-case basis; artificial siding on areas visible to the public right-of-way is discouraged where such materials would replace or damage original building materials that are in good condition
>
> All changes and additions should respect existing environmental settings, landscaping, and patterns of open space.

Montgomery County Code, Chapter 24A Historic Resources Preservation

(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 insure 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.

STAFF DISCUSSION

The applicant proposes to install 32 roof-mounted solar panels and related electrical equipment. All of the panels will be placed on the front and rear shed dormers. The panels will be installed using a rack system that projects approximately 4" (four inches) above the roof surface. The panels selected for this project are all black with matte black frames. Staff finds that this proposed work complies with the *Guidelines* and recommends approval.

Eighteen of the solar panels will be placed on the rear shed dormer and will only be minimally visible from the public right-of-way. This change will not impact historic materials or the massing of the historic features of the house and Staff supports its approval.

The remaining 14 solar panels are proposed for the front shed dormer in a single array. Staff initially had concerns about the visibility of solar panels in this location. However, due to the low (7 degree) slope of the dormer, Staff finds that this installation will have limited visual impact on the massing of the roof form, the historic building, and surrounding district. Additionally, as this proposal calls for a single array that will extend almost to the edges of the dormer (see Circle:

14), the installation will result in a more uniform appearance that will not detract in the way multiple clusters of solar panels would.

Staff's only concerns about the current proposal is the highly visible location identified for the new electrical hardware: specifically the inverter and its conduit. The rendering shown in Circle: 9 shows a bright white inverter box installed prominently at the front right corner of the house with a new black electrical conduit. The placement of the inverter near the electric box seems reasonable to Staff due it its proximity to the electric meter. However, Staff finds the placement of the inverter to be too high, and that it will visually detract from the appearance of the historic building in this prominent location. Staff recommends the Historic Preservation Commission including a condition for approval that lowers the inverter box and limits its placement to be no higher than the window sill on the north side of the house. Staff further recommends that the HPC require any new conduit associated with the installation of the inverter on this wall to be painted to match the historic house (as was done for the electric meter in the same approximate location).

STAFF RECOMMENDATION

Staff recommends the HPC **approve with one (1) conditions** the HAWP application;

1. The proposed location of the inverter box is too prominent. The inverter box must be installed below the level of the window sills on the north wall and any additional electrical conduit needs to be painted to match the historic house.

and with the general condition applicable to all Historic Area Work Permits that **the applicant will present *3 permit sets* of drawings to HPC staff for review and stamping prior to submission for permits (if applicable).** After issuance of the Montgomery County Department of Permitting Services (DPS) permit, the applicant will arrange for a field inspection by calling the DPS Field Services Office at 240-777-6370 prior to commencement of work and not more than two weeks following completion of work.

Historic Area Work Permit Application for a Solar Electric System
on the home of
Thomas LaLonde, 7112 Sycamore Ave., Takoma Park, MD 20912

[redacted]

DPS - #8

HISTORIC PRESERVATION COMMISSION
301/563-3400

APPLICATION FOR HISTORIC AREA WORK PERMIT

Contact Email: tlampros@solarenergyworld.com Contact Person: Tom Lampros
Daytime Phone No.: 410.579.5177

Tax Account No.: 13-01073307

Name of Property Owner: Thomas A. LaLonde Daytime Phone No.: 301.920.0236

Address: 7112 Sycamore Ave., Takoma Park, MD 20912
Street Number *City* *State* *Zip Code*

Contractor: Solar Energy World, LLC Phone No.: 410.579.2009

Contractor Registration No.:

Agent for Owner: Mike Kirby Daytime Phone No.: 410.409.0228

LOCATION OF BUILDING/PREMISE

House Number: 7112 Street: Sycamore Ave.

Town/City: Takoma Park Nearest Cross Street:

Lot: 11 Block: 21 Subdivision: 0025

Liber: Folio: Parcel:

PART ONE: TYPE OF PERMIT ACTION AND USE

1A. CHECK ALL APPLICABLE:

☐ Construct ☐ Extend ☐ Alter/Renovate
☐ Move ☒ Install ☐ Wreck/Raze
☐ Revision ☐ Repair ☐ Revocable

CHECK ALL APPLICABLE:

☐ A/C ☐ Slab ☐ Room Addition ☐ Porch ☐ Deck ☐ Shed
☒ Solar ☐ Fireplace ☐ Woodburning Stove ☐ Single Family
☐ Fence/Wall (complete Section 4) ☐ Other:

1B. Construction cost estimate: $

1C. If this is a revision of a previously approved active permit, see Permit #

PART TWO: COMPLETE FOR NEW CONSTRUCTION AND EXTENDED/ADDITIONS

2A. Type of sewage disposal: 01 ☐ WSSC 02 ☐ Septic 03 ☐ Other:

2B. Type of water supply: 01 ☐ WSSC 02 ☐ Well 03 ☐ Other:

PART THREE: COMPLETE ONLY FOR FENCE/RETAINING WALL

3A. Height feet inches

3B. Indicate whether the fence or retaining wall is to be constructed on one of the following locations:

☐ On party line/property line ☐ Entirely on land of owner ☐ On public right of way/easement

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

Thomas M Lampros
Signature of owner or authorized agent

4/9/18
Date

Approved: *For Chairperson, Historic Preservation Commission*

Disapproved: Signature: Date:

Application/Permit No.: Date Filed: Date Issued:

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Historic Area Work Permit Application for a Solar Electric System

on the home of

Thomas LaLonde, 7112 Sycamore Ave., Takoma Park, MD 20912

1. Written description of the project
    a. The existing structure is a Craftsman-style bungalow, one-story in front and two-story in the rear. It was constructed in 1921. The neighborhood is of the same vintage.
    b. The proposed solar system will be flush-mounted to the rear (south facing) and front (north facing) roofs of dormers on the primary section of the home. The majority of the solar panels will be on the rear of the building. The height and tilt of the roof will pose little disruption to the environment of the neighborhood, as it will be nearly unnoticeable from the street level.
2. Site Plan
    a. Please see attached Solar Panel Layout
    b. 2 copies, 11"x17"
3. Plans & Elevations
    a. N/A
4. Materials Specifications
    a. Please see attached spec sheets for module and inverter
5. Photographs
    a. Please see photos below
6. Tree Survey – no trees will be disturbed or removed as part of this work
7. Addresses of Adjacent and Confronting Property Owners

Owner's mailing address	Owner's agent mailing address
Thomas LaLonde & Julia D Zito 7112 Sycamore Ave. Takoma Park, MD 20912	Solar Energy World 5681 Main St. Elkridge, MD 21075
Adjacent and confronting property owners mailing addresses	
Lot 10, Block 21 Adjoining	Fredrick Feinstein 7114 Sycamore Ave. Takoma Park, MD 20912
Lot 12, Block 21 Adjoining	Joan Marsh 7110 Sycamore Ave. Takoma Park, MD 20912
Lot 9, Block 21 Confronting	Frances Burwell & James Meen 7113 Sycamore Ave. Takoma Park, MD 20912
Lot 50, Block 21 Rear-adjoining	Cynthia Hallberlin 713 Poplar Ave. Takoma Park, MD 20912

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Historic Area Work Permit Application for a Solar Electric System

on the home of

Thomas LaLonde, 7112 Sycamore Ave., Takoma Park, MD 20912

Existing Property Condition Photographs

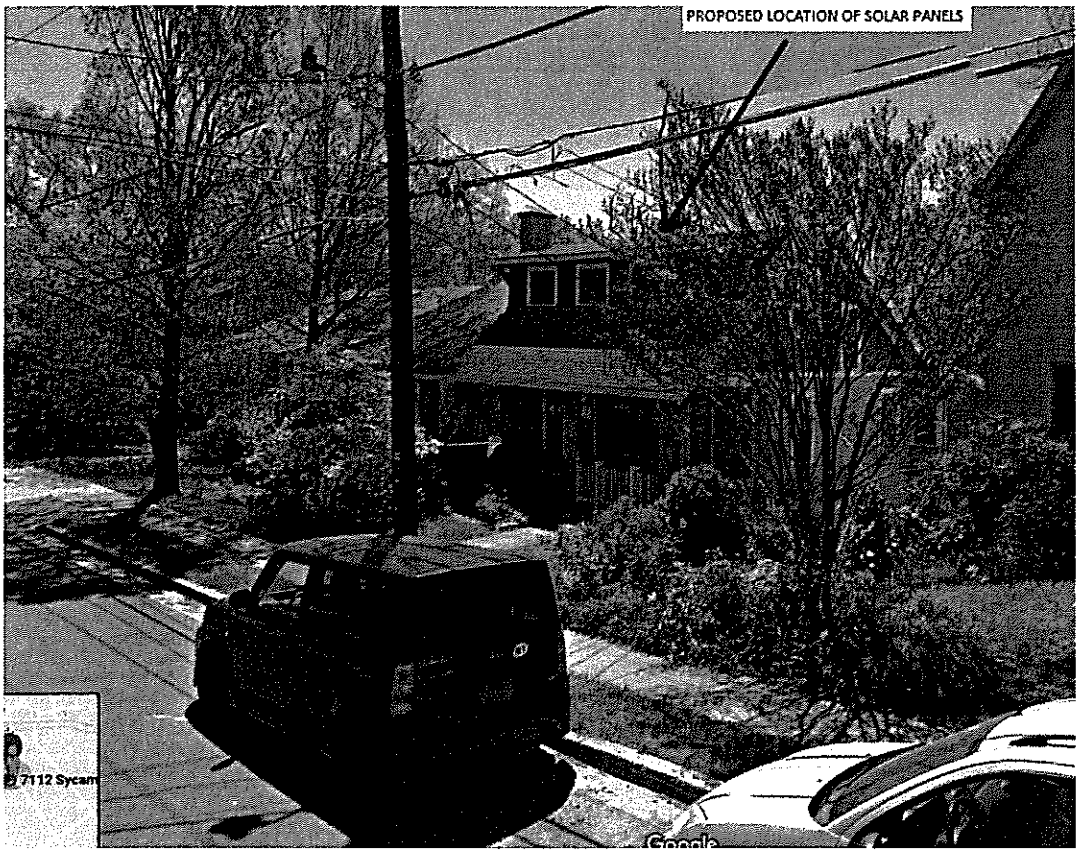
Front view

East view

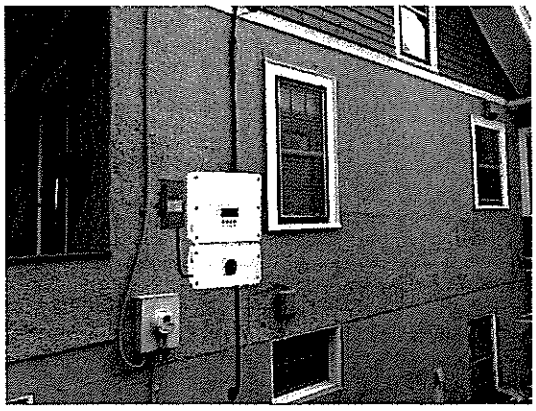
Historic Area Work Permit Application for a Solar Electric System

on the home of

Thomas LaLonde, 7112 Sycamore Ave., Takoma Park, MD 20912



West view



Equipment Location, Before and After Installation

StruDes Consulting, Inc.
2027 Buell Drive, Frederick, MD 21702
240-457-3775, ryadava@gmail.com

March 26, 2018

To: Solar Energy World
5681 Main Street
Elkridge, MD 21075

Subject: Structural Certification for Solar Panels Installation on Roof of
Tom Lalonde Residence, 7112 Sycamore Avenue, Takoma Park, MD 20912

To whom it may concern,

A design check of the existing roof support framing system at the subject residence was performed for installation of solar panels.

Field measurements / inspection of the roof support framing system, by the client's auditors, are as follows:

The roof structure consists of asphalt shingles on 1" thick wood panels supported on timber rafters.

The roof section "S1" has a maximum projected horizontal span of 24'-2" between load bearing walls, and a roof slope of 7°. The maximum unsupported projected horizontal span of the roof rafters is approximately 12.1 ft. The roof rafters are timber 2"x6" spaced at 24" OC.

The above existing roof support framing system "S1" is judged to be adequate subject to all code specified design loads and additional loading imposed by the installation of the solar panels. No reinforcement is required.

The spacing of the solar "L Feet" should be as specified in drawing titled "Solar Panel Footing Plan", with a staggered pattern to ensure proper distribution of imposed loads.

I further certify that all applicable loads required by the current codes and design criteria listed below were applied and analyzed. Furthermore, the installation crews have been thoroughly trained to install the solar panels following all the installation recommendations specified by Unirac Solarmount for the racking system and Ecofasten for the connecting to the roof. Finally, I accept the certifications provided by the solar panel manufacturer for the ability of the panels to withstand design wind and snow loads.

Design Criteria:

- Applicable Design Codes = 2015 IBC / IRC, ASCE 7-10, and NDS-2015
- Roof Dead Load = 10.1 psf
- Ultimate Design Wind Speed = 115 mph, Exposure B
- Ground Snow Load = 30 psf
- Sloped Roof Design Snow Load = 22.7 psf

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StruDes Consulting, Inc.
2027 Buell Drive, Frederick, MD 21702
240-457-3775, ryadava@gmail.com

If any condition is found to be different from what is shown on the drawings or there appears to be any damage to the structure, please halt the solar panel installation and notify our office.

Should you have any question or concerns regarding this project, please feel free to contact me.

Sincerely,

Rabi Shankar Singh Yadava, PhD, PE, PMP

Structural Engineer
StruDes Consulting, Inc.

DocuSigned by:

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Professional Certification: I hereby certify that these plans were prepared or approved by me, and I am duly licensed professional engineer under the laws of the State of Maryland. License No. 28331. Expiration Date: November 05, 2019.

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StruDes Consulting, Inc.
2027 Buell Drive, Frederick, MD 21702
240-457-3775, ryadava@gmail.com

Project Property Owner

Tom Lalonde

Address

7112 Sycamore Avenue, Takoma Park, MD 20912

■ 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 32 nos. 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) and International Existing Building Code (IEBC) adopted by Montgomery County 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 and IEBC 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 and IEBC, 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 and IEBC, 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.

28331
Maryland PE License Number

DocuSigned by:

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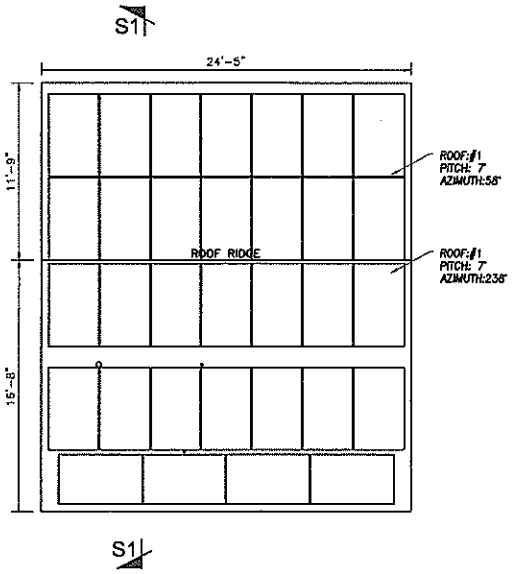
Seal & Signature

Date: 3 – 26 – 2018

12



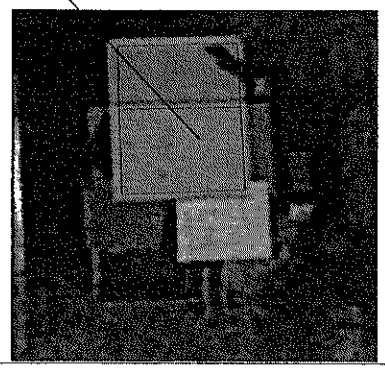
SOLAR PANEL LAYOUT

Scale: 1/8" =1'-0"

NOTES:

1. THE SYSTEM SHALL INCLUDE [32] TRINA SOLAR TSM-300DD05A.05(II) MODULES
2. UNIRAC SOLARMOUNT RAIL WILL BE INSTALLED IN ACCORDANCE WITH UNIRAC INSTALLATION MANUAL 227.3.
3. DIMENSIONS MARKED (*) ARE ALONG ROOF SLOPE.
4. REFER TO STRUCTURAL DRAWING FOR SECTIONS MARKED AND ADDITIONAL NOTES.

PROPOSED PV ARRAY LOCATION



General Notes

SolarEnergyWorld

Because Tomorrow Matters

Solar Energy World LLC.
5681 Main Street
Elkridge, MD 21075
(888) 497-3233

Stamp

DocuSigned by:

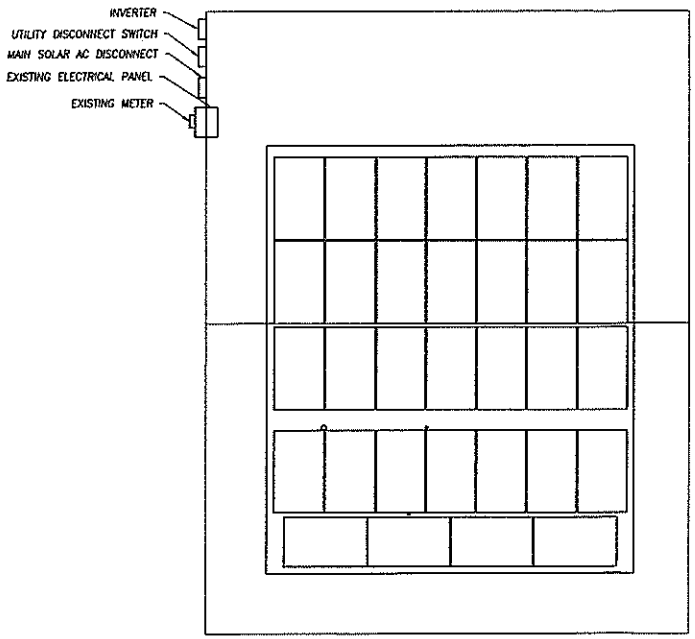
F0FE63F591F445B...

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. 28331, EXPIRATION DATE: NOVEMBER 05, 2019.
*STAMPED AND SIGNED FOR STRUCTURES ONLY

Project Name and Address

Tom Lalonde
7112 Sycamore Ave.
Takoma Park, MD 20912
9.6 kW

Drawn by	Sheet
MDM/TML	A001
Date: 3/23/18	
Scale: AS NOTED	



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.

General Notes

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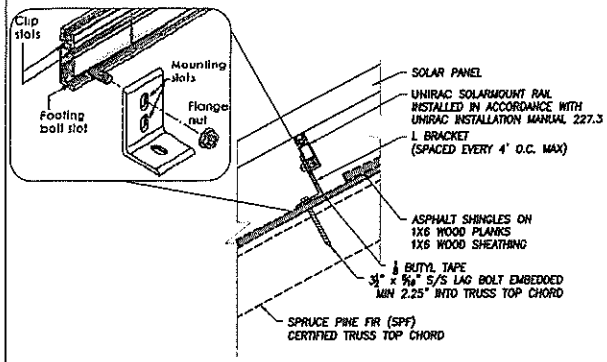
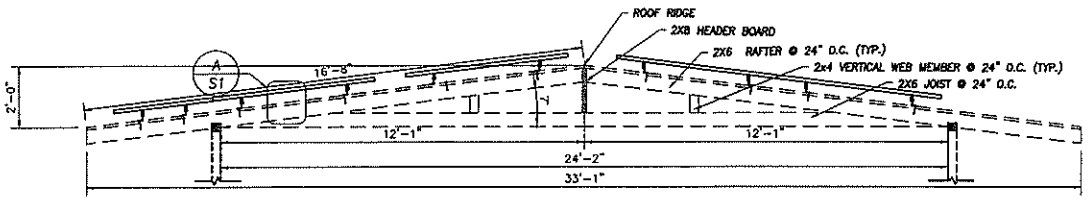
Drawn By: MDM/TML	Sheet: E001
Date: 3/23/18	
Scale: AS NOTED	



DETAIL A / S1
Scale: NTS



STRUCTURAL SECTION S1
Scale: 1/4" =1'-0"

S1

NOTES:

1. ALL WORK SHALL COMPLY WITH REQUIREMENTS OF INTERNATIONAL RESIDENTIAL CODE (IRC 2015), LOADING CODE (ASCE 7-10), WOOD DESIGN CODE(NDS 2015) AND LOCAL REQUIREMENTS.
2. LOAD CRITERIA PER :
   - EXPOSURE CATEGORY "B"
   - GROUND SNOW LOAD, Pg = 30 PSF
   - 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.

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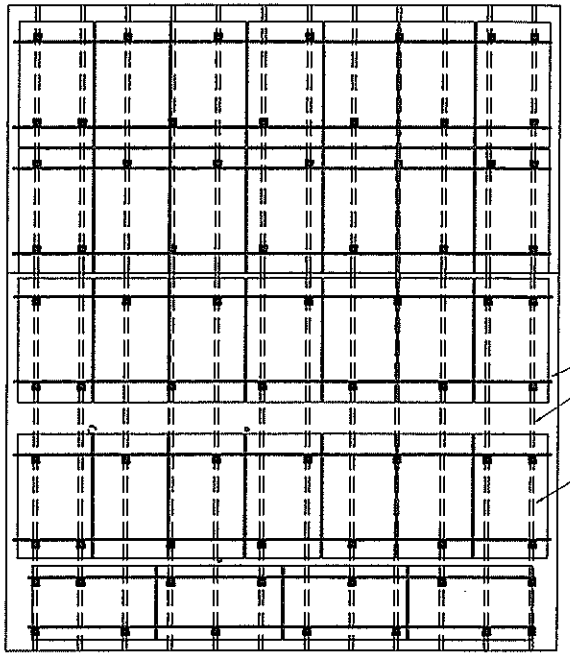

(1)

NOTES:

1. UNIRAC SOLARMOUNT RAIL SHALL BE INSTALLED IN ACCORDANCE WITH UNIRAC INSTALLATION MANUAL 227.3.
2. "L" FEET SHALL BE SPACED AT A MAXIMUM OF 4' O/C.
3. AN "L" FOOT SHALL BE PLACED WITHIN 25% OF MAXIMUM "L" FOOT SPACING (1' MAX.) AT THE CANTILEVERED END OF EACH SECTION OF RAIL.
4. PROPOSED BALLAST BLOCK:
   SIZE = 2.2"X8"X16"
   WEIGHT = 14.5LBS

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

General Notes

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Because Tomorrow Matters
Solar Energy World LLC.
5681 Main Street
Elkridge, MD 21075
(888) 497-3233

Disclaimer:
This drawing is the property of Solar Energy World Inc. The information herein contained shall be used for the sole benefit of Solar Energy World. It shall not be disclosed to others outside the recipient's organization, in whole or in part, without the written permission of Solar Energy World, except in connection with the sale and use of the respective Solar Energy equipment.

Stamp

DocuSigned by:
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Takoma Park, MD 20912
9.6 kW

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MDM/TML	S002
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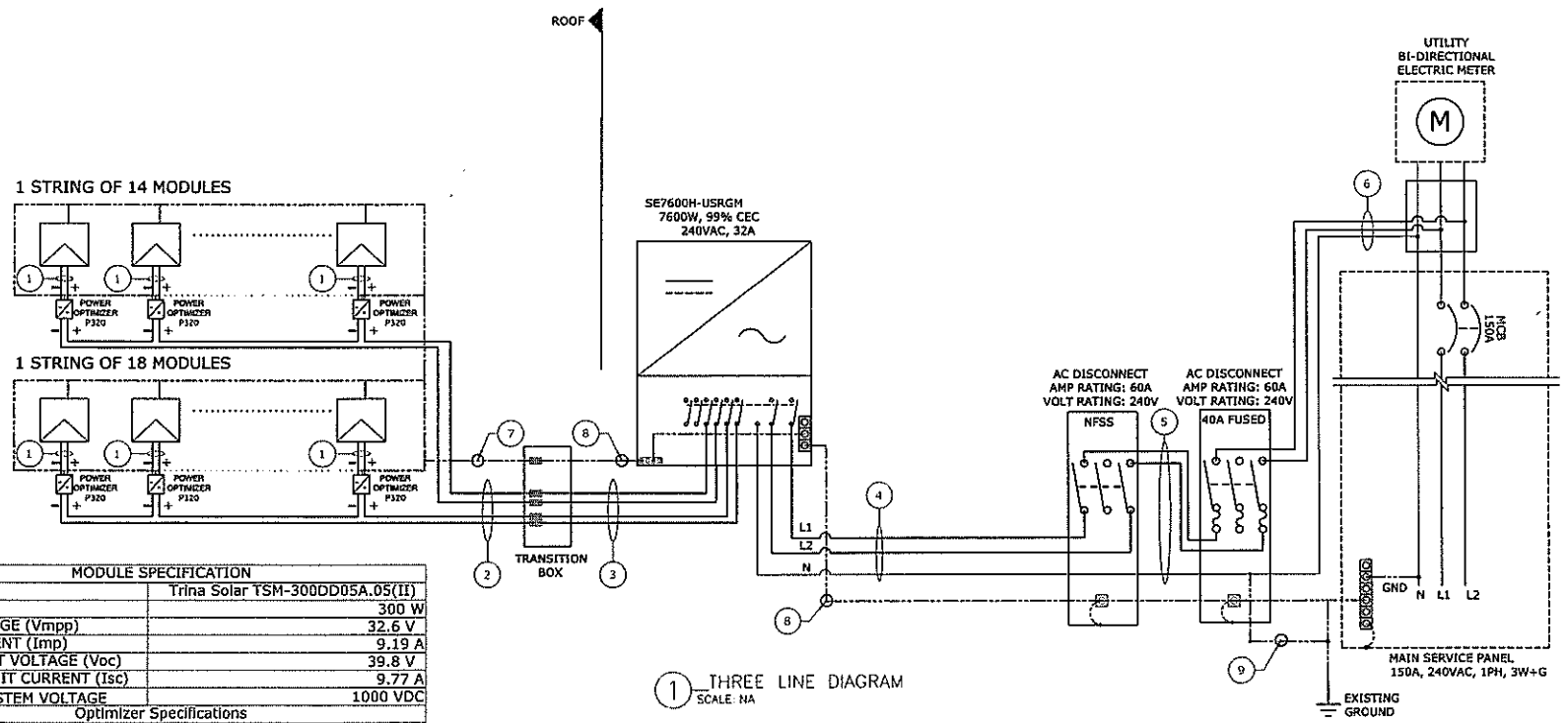


1 THREE LINE DIAGRAM
SCALE: NA

MODULE SPECIFICATION		
MODEL NO.	Trina Solar TSM-300DD05A.05(II)	
PEAK POWER		300 W
RATED VOLTAGE (Vmpp)		32.6 V
RATED CURRENT (Imp)		9.19 A
OPEN CIRCUIT VOLTAGE (Voc)		39.8 V
SHORT CIRCUIT CURRENT (Isc)		9.77 A
MAXIMUM SYSTEM VOLTAGE		1000 VDC
Optimizer Specifications		
OPTIMIZER MODEL		P320
MAXIMUM DC VOLTAGE		48 V
MAXIMUM POWER OUTPUT		320 W
MAXIMUM DC CURRENT OUTPUT		15 A
MAXIMUM DC CURRENT INPUT		13.75 A
Inverter Specifications		
INVERTER MODEL		SE7600H-USRGM
MAXIMUM DC VOLTAGE		500 V
MAXIMUM POWER OUTPUT		7600 W
NOMINAL AC VOLTAGE		240 VAC
MAXIMUM AC CURRENT		32 A
ARRAY DETAILS		
NO. OF MODULES PER STRINGS	14	18
NO. OS STRINGS	1	1
ARRAY WATTS AT STC	4200	5400
MAX. VOLTAGE	500	500
690.53 Label Info.		
RATED VOLTAGE	400 V	400 V
RATED CURRENT	10.50A	13.50A
MAX. SYSTEM VOLTAGE	500 V	500 V
SHORT CIRCUIT CURRENT	15 A	15 A

WIRE/CONDUIT SCHEDULE ARRAY			
TAG	DESCRIPTION	WIRE SIZE/TYPE	NOTES
1	Panel to Optimizer	#10 USE-2	
2	Optimizer to Transition Box	#10 PV WIRE	
3	Transition Box to DC Disconnect	#10 THHN/THWN-2 IN EMT	
	DC Disconnect to Inverter	NA	Integrated
4	Inverter to Production Meter	#6 Cu THHN/THWN-2	
5	Production Meter to AC disconnect	#6 Cu THHN/THWN-2	
6	AC disconnect to Interconnection Point	#6 Cu THHN/THWN-2	
7	Equipment Grounding Conductor	#10 Cu Bare Copper Wire	
8	Equipment Grounding Conductor	#10 Cu THHN-THWN-2	
9	Grounding Electrode Conductor	#8 Cu or #6 Cu if exposed to physical damage	

GENERAL ELECTRICAL NOTES, NEC 2014

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 MODULES SHALL BE NEGATIVELY GROUNDED. GROUNDED (NEGATIVE) CONDUCTORS SHALL BE UN-FUSED AND UN-BROKEN FROM THE ARRAY TO THE INVERTER DC TERMINAL. UN-GROUNDED (POSITIVE) CONDUCTORS SHALL BE FUSED AND/OR SWITCHED
5 COPPER CONDUCTORS SHALL BE USED AND SHALL HAVE INSULATION RATING 600V 90°C UNLESS OTHERWISE NOTED
6 CONDUCTORS SHALL BE SIZED IN ACCORDANCE TO NEC. CONDUCTORS AMPACITY SHALL BE DE-RATED FOR TEMPERATURE INCREASE, CONDUIT FILL AND VOLTAGE DROP.
7 ALL CONDUCTORS, EXCEPT USE-2, SHALL BE INSTALLED IN APPROVED CONDUITS OR RACEWAY CONDUITS SHALL BE ADEQUATELY SUPPORTED AS PER NEC
8 AC DISCONNECT SHOWN IS REQUIRED IF THE UTILITY REQUIRES VISIBLE-BLADE SWITCH
9 EXPOSED NON-CURRENT CARRYING METAL PARTS SHALL BE GROUNDED AS PER NEC
10 LOAD SIDE INTER-CONNECTION SHALL COMPLY WITH NEC
11 SMS MONITORING SYSTEM AND IT'S CONNECTION SHOWN IS OPTIONAL. IF USED, REFER TO SMS INSTALLATION MANUAL FOR WIRING METHODS AND OPERATION PROCEDURE
12 ASHRAE FUNDAMENTAL OUTDOOR DESIGN TEMPERATURES DO NOT EXCEED 47°C IN THE U.S. (PHOENIX AZ or PALM SPRINGS, CA)
13 FOR LESS THAN 9 CURRENT-CARRYING CONDUCTORS IN ROOF MOUNTED SUNLIGHT CONDUIT USING THE OUTDOOR TEMPERATURE OF 47°C
13.1 12AWG CONDUCTOR ARE GENERALLY ACCEPTABLE FOR MODULES WITH ATC I.S. OF 9.4 AMPS WITH A 10 AMP FUSE.
13.2 10AWG CONDUCTOR ARE GENERALLY ACCEPTABLE FOR MODULES WITH ATC I.S. OF 9.6 AMPS WITH A 15 AMP FUSE

Wire Sizing for EXCEL
EXCEL =(1.25*1.25*# of strings in parallel)* wire amps per ul using NEC table 690.8

SOLAR ENERGY WORLD LLC.
5601 Main Street
Ellicott City, MD 21043

ENGINEER'S STAMP

Tom LaLonde
9.60 kW
7122 Sycamore Ave.
Takoma Park, MD 20912

Three Line Electrical Drawing

REVISIONS					
REV	DESCRIPTION	DATE	BY	CK
1				

OPPORTUNITY	
PROJECT	
DATE DRAWN	03/26/18
DRAWN BY	DTK
DMS #:	REV. **
SHEET	E1

THE

ALLMAX PLUS

FRAMED 60-CELL MODULE

60 CELL
MONOCRYSTALLINE MODULE

300W
POWER OUTPUT RANGE

18.3%
MAXIMUM EFFICIENCY

-5~+3%W
POWER TOLERANCE

Founded in 1997, Trina Solar is the world's leading comprehensive solutions provider for solar energy. we believe close cooperation with our partners is critical to success. Trina Solar now distributes its PV products to over 60 countries all over the world. Trina is able to provide exceptional service to each customer in each market and supplement our innovative, reliable products with the backing of Trina as a strong, bankable partner. We are committed to building strategic, mutually beneficial collaboration with installers, developers, distributors and other partners.

Comprehensive Products And System Certificates

IEC61215/IEC61730/UL1703/IEC61701/IEC62716
ISO 9001: Quality Management System
ISO 14001: Environmental Management System
ISO14064: Greenhouse gases Emissions Verification
OHSAS 18001: Occupation Health and Safety Management System

Maximize limited space with top-end efficiency

- Up to 192W/m² power density
- Low thermal coefficients for greater energy production at high operating temperatures

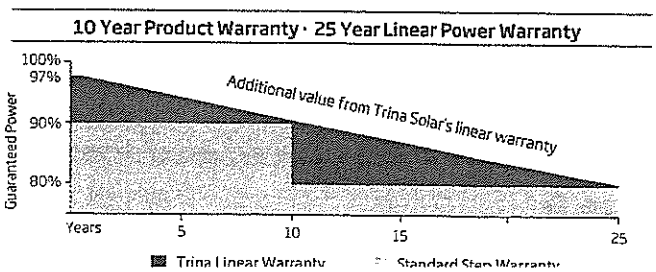
Highly reliable due to stringent quality control

- Over 30 in-house tests (UV, TC, HF, and many more)
- In-house testing goes well beyond certification requirements
- PID resistant
- 100% EL double inspection
- Selective emitter, advanced surface texturing

Certified to withstand the most challenging environmental conditions

- 2400 Pa wind load
- 5400 Pa snow load
- 35 mm hail stones at 97 km/h

LINEAR PERFORMANCE WARRANTY



Trinasolar

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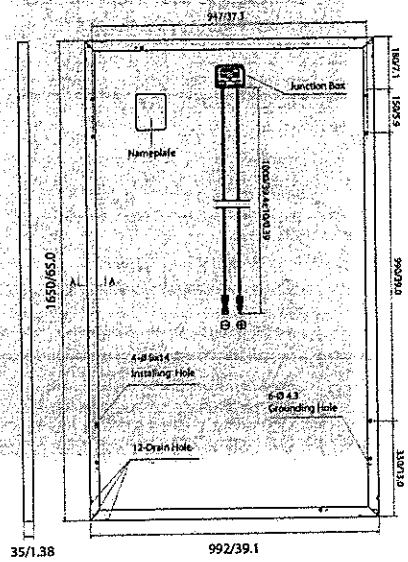
ALLMAX™ PLUS+

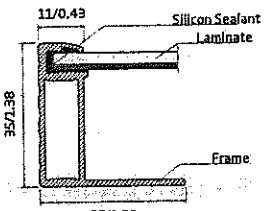
FRAMED 60-CELL MODULE

PRODUCTS	POWER RANGE
TSM-DD05A.05(II)	300W

DIMENSIONS OF PV MODULE(mm/inches)

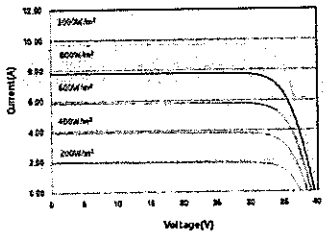


Back View

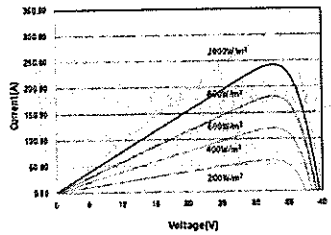


(A-A)

I-V CURVES OF PV MODULE (300W)



P-V CURVES OF PV MODULE (300W)



ELECTRICAL DATA (STC)

Peak Power Watts-P_{MAX} (Wp)*	300
Power Output Tolerance-P_{MAX} (W)	-5 ~ +3%
Maximum Power Voltage-V_{MPP} (V)	32.6
Maximum Power Current-I_{MPP} (A)	9.19
Open Circuit Voltage-V_{OC} (V)	39.8
Short Circuit Current-Isc (A)	9.77
Module Efficiency η_m (%)	18.3

STC: Irradiance 1000W/m², Cell Temperature 25°C, Air Mass AM1.5.
*Measuring tolerance: ±3%.

ELECTRICAL DATA (NOCT)

Maximum Power-P_{MAX} (Wp)	223
Maximum Power Voltage-V_{MPP} (V)	30.2
Maximum Power Current-I_{MPP} (A)	7.38
Open Circuit Voltage-V_{OC} (V)	37.0
Short Circuit Current-Isc (A)	7.89

NOCT: Irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline 156.75 × 156.75 mm (6 inches)
Cell Orientation	60 cells (6 × 10)
Module Dimensions	1650 × 992 × 35 mm (65.0 × 39.1 × 1.38 inches)
Weight	18.6 kg (41.0 lb)
Glass	3.2 mm (0.13 inches), High Transmission, AR Coated Tempered Glass
Backsheet	Black [DD05A.05(II)]
Frame	Black Anodized Aluminium Alloy
J-Box	IP 67 or IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm² (0.006 inches²), 1000 mm (39.4 inches)
Connector	MC4 or Amphenol UTX
Fire Type	Type 1 or Type 2

TEMPERATURE RATINGS

NOCT (Nominal Operating Cell Temperature)	44°C (±2°C)
Temperature Coefficient of P_{MAX}	- 0.39%/°C
Temperature Coefficient of V_{OC}	- 0.29%/°C
Temperature Coefficient of Isc	0.05%/°C

MAXIMUM RATINGS

Operational Temperature	-40~+85°C
Maximum System Voltage	1000V DC (IEC)
	1000V DC (UL)
Max Series Fuse Rating	20A

(DO NOT connect Fuse in Combiner Box with two or more strings in parallel connection)

WARRANTY

10 year Product Workmanship Warranty

25 year Linear Power Warranty

(Please refer to product warranty for details)

PACKAGING CONFIGURATION

Modules per box: 30 pieces

Modules per 40' container: 840 pieces

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CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

Version number: TSM_EN_2017_EXTENDED_A

www.trinasolar.com

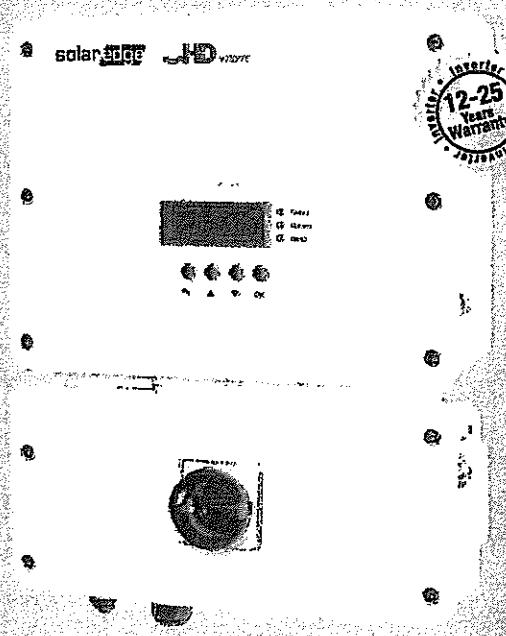
solaredge

SolarEdge Single Phase Inverters

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US

INVERTERS



Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking efficiency
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014 and 2017, per article 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Extremely small and easy to install outdoors or indoors
- High reliability without any electrolytic capacitors
- Built-in module-level monitoring
- Optional: Revenue grade data, ANSI C12.20 Class 0.5 (0.5% accuracy)

HD wave

Single Phase Inverters for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/ SE7600H-US

	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	
OUTPUT						
Rated AC Power Output	3000	3800	5000	6000	7600	VA
Max. AC Power Output	3000	3800	5000	6000	7600	VA
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	-	✓	-	-	Vac
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	Vac
AC Frequency (Nominal)	59.3 - 60 - 60.5[1]					Hz
Maximum Continuous Output Current 208V	-	-	24	-	-	A
Maximum Continuous Output Current 240V	12.5	16	21	25	32	A
GFDI Threshold	1					A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes					
INPUT						
Maximum DC Power	4650	5900	7750	9300	11800	W
Transformer-less, Ungrounded	Yes					
Maximum Input Voltage	480					Vdc
Nominal DC Input Voltage	380				400	Vdc
Maximum Input Current 208V [2]	-	-	13.5	-	-	Adc
Maximum Input Current 240V [2]	8.5	10.5	13.5	16.5	20	Adc
Max. Input Short Circuit Current	45					Adc
Reverse-Polarity Protection	Yes					
Ground-Fault Isolation Detection	600kΩ Sensitivity					
Maximum Inverter Efficiency	99	99.2				%
CEC Weighted Efficiency	99					%
Nighttime Power Consumption	< 2.5					W
ADDITIONAL FEATURES						
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional), Cellular (optional)					
Revenue Grade Data, ANSI C12.20	Optional[3]					
Rapid Shutdown - NEC 2014 and 2017 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect					
STANDARD COMPLIANCE						
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07					
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)					
Emissions	FCC Part 15 Class B					
INSTALLATION SPECIFICATIONS						
AC Output Conduit Size / AWG Range	0.75-1" Conduit / 14-6 AWG					
DC Input Conduit Size / # of Strings / AWG Range	0.75-1" Conduit /1-2 strings / 14-6 AWG					
Dimensions with Safety Switch (HxWxD)	17.7 x 14.6 x 6.8 / 450 x 370 x 174					in / mm
Weight with Safety Switch	22 / 10		25.1 / 11.4	26.2 / 11.9		lb / kg
Noise	< 25				< 50	dBA
Cooling	Natural Convection				Natural convection and internal fan (user replaceable)	
Operating Temperature Range	-13 to +140 / -25 to +60[4] (-40°F / -40°C option)[5]					°F / °C
Protection Rating	NEMA 3R (Inverter with Safety Switch)					

[1] For other regional settings please contact SolarEdge support
[2] A higher current source may be used; the inverter will limit its input current to the values stated
[3] Revenue grade inverter P/N: SExxxxH-US000NNC2
[4] Power de-rating from 50°C
[5] -40 version P/N: SExxxxH-US000NNU4

RoHS

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SM SOLAR MOUNT

INSTALLATION GUIDE

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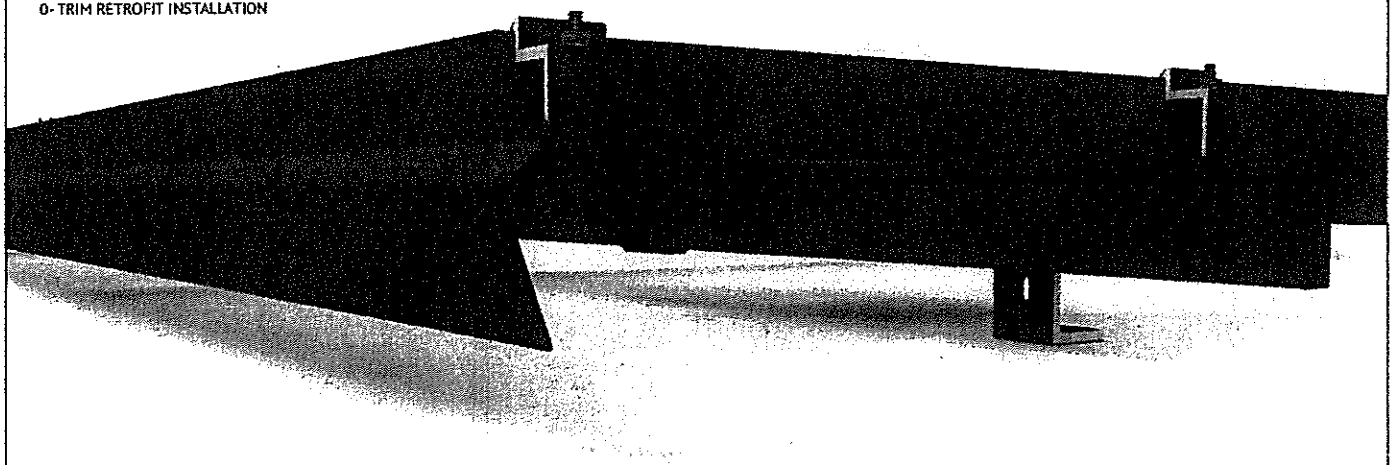

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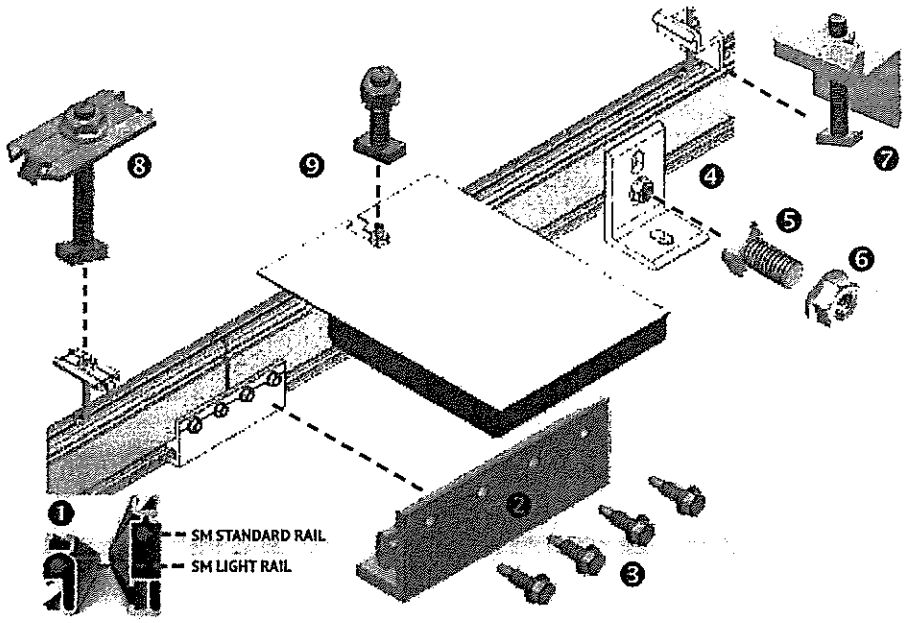


Wrenches and Torque

	Wrench Size	Recommended Torque (ft-lbs)
1/4" Hardware ●●●	7/16"	*10
3/8" Hardware ●	9/16"	*30
#12 Hardware ●	5/16"	10

Torques are not designed for use with wood connectors
*w/Anti-Seize.

Anti-Seize*

Stainless steel hardware can seize up, a process called galling. To significantly reduce its likelihood:
1. Apply minimal lubricant to bolts, preferably Anti-Seize commonly found at auto parts stores
2. Shade hardware prior to installation, and
3. Avoid spinning stainless nuts onto bolts at high speed.

❶**RAIL:** Supports PV modules. Use at least two per row of modules. Aluminum extrusion, available in mill, clear anodized, or dark anodized.

❷**RAIL SPLICE:** Non structural splice joins, aligns, and electrically bonds rail sections into single length of rail. Forms either a rigid or thermal expansion joint, 4 inches long, pre-drilled (see page F). Anodized aluminum extrusion available in clear or dark.

❸**SELF-DRILLING SCREW:** (No. 12 x ¾") – Use 4 per rigid splice or 2 per expansion joint. Stainless steel. Supplied with splice. In combination with rigid splice, provides rail to rail bond.

❹**L-FOOT:** Use to secure rails through roofing material to building structure. Refer to loading tables or U-Builder for spacing.

❺**L-FOOT T- BOLT:** (3/8" x ¾") – Use one per L-foot to secure rail to L-foot. Stainless steel. Supplied with L-foot. In combination with flange nut, provides electrical bond between rail and L-foot.

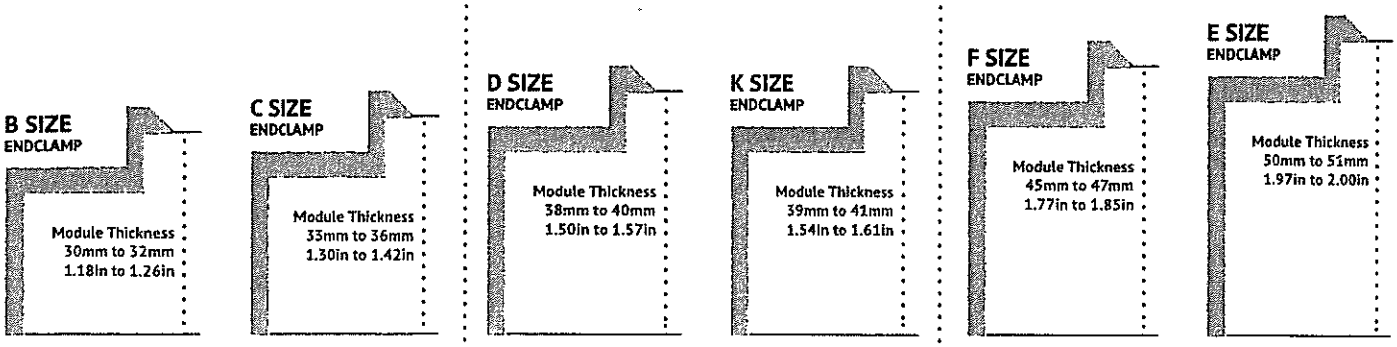
❻**SERRATED FLANGE NUT (3/8"):** Use one per L-foot to secure and bond rail to L-foot. Stainless steel. Supplied with L-foot.

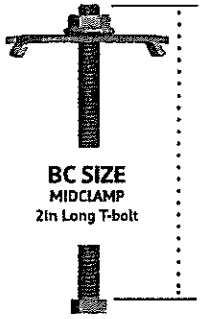
❼**MODULE ENDCLAMP:** Provides bond from rail to endclamp. Pre-assembled aluminum clamp available in clear or dark finish. Supplied washer keeps clamp and bolt upright for ease of assembly.

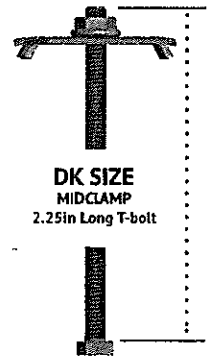
❽**MODULE MIDCLAMP:** Pre-assembled clamp provides module to module and module to rail bond. Stainless steel clamp and T-bolt. Available in clear or dark finish.

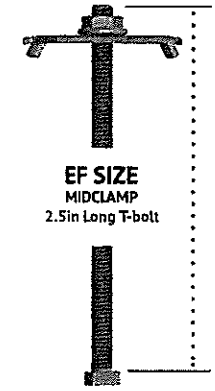
❾**MICROINVERTER MOUNTING BOLT:** Pre-assembled bolt and nut attaches and bonds microinverter to rail. Washer at base keeps bolt upright for ease of assembly.

NOTE - POSITION INDICATOR: T-bolts have a slot in the hardware end corresponding to the direction of the T-Head.


B SIZE
ENDCLAMP
Module Thickness
30mm to 32mm
1.18in to 1.26in
C SIZE
ENDCLAMP
Module Thickness
33mm to 36mm
1.30in to 1.42in
D SIZE
ENDCLAMP
Module Thickness
38mm to 40mm
1.50in to 1.57in
K SIZE
ENDCLAMP
Module Thickness
39mm to 41mm
1.54in to 1.61in
F SIZE
ENDCLAMP
Module Thickness
45mm to 47mm
1.77in to 1.85in
E SIZE
ENDCLAMP
Module Thickness
50mm to 51mm
1.97in to 2.00in


BC SIZE
MIDCLAMP
2in Long T-bolt


DK SIZE
MIDCLAMP
2.25in Long T-bolt


EF SIZE
MIDCLAMP
2.5in Long T-bolt

PLANNING YOUR SOLARMOUNT INSTALLATIONS

The installation can be laid out with rails parallel to the rafters or perpendicular to the rafters. Note that SOLARMOUNT rails make excellent straight edges for doing layouts.

Center the installation area over the structural members as much as possible.

Leave enough room to safely move around the array during installation. Some building codes and fire codes require minimum clearances around such installations, and the installer should check local building code requirements for compliance.

The length of the installation area is equal to:

- the total width of the modules,
- plus ¼" inch for each space between modules (for mid- clamp),
- plus approximately 3 inches (1½ inches for each Endclamp)

LAYING OUT L-FEET FOR TOP CLAMPS

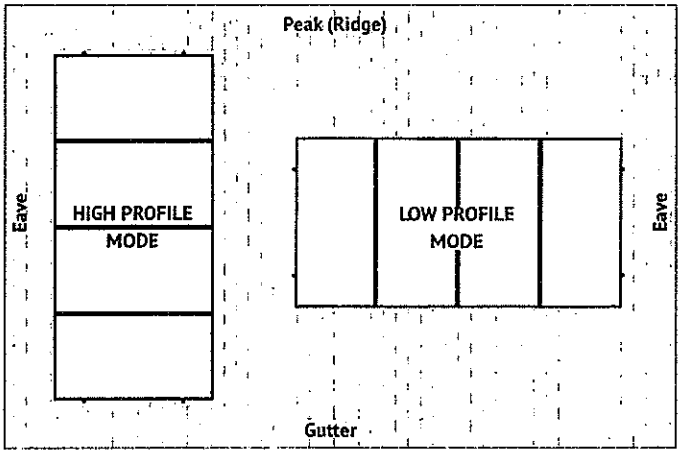
L-feet, in conjunction with proper flashing equipment and techniques, can be used for attachment through existing roofing material, such as asphalt shingles, sheathing or sheet metal to the building structure.

Locate and mark the position of the L-feet lag screw holes within the installation area as shown below. Follow manufacturer module guide for rail spacing based on appropriate mounting locations.

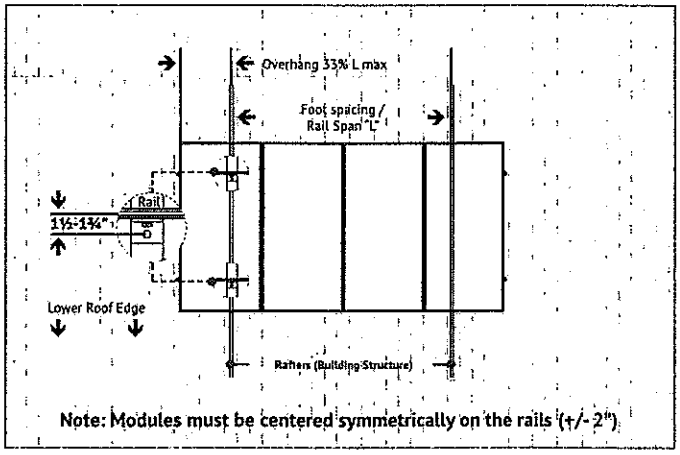
If multiple rows are to be installed adjacent to one another, it is not likely that each row will be centered above the rafters. Adjust as needed, following the guidelines below as closely as possible.

Refer to Unirac Solarmount D&E Guide & U-Builder for allowable spans and cantilevers.

RAILS MAY BE PLACED PARALLEL OR PERPENDICULAR TO RAFTERS



LAYOUT WITH RAILS PERPENDICULAR TO RAFTERS (RECOMMENDED)



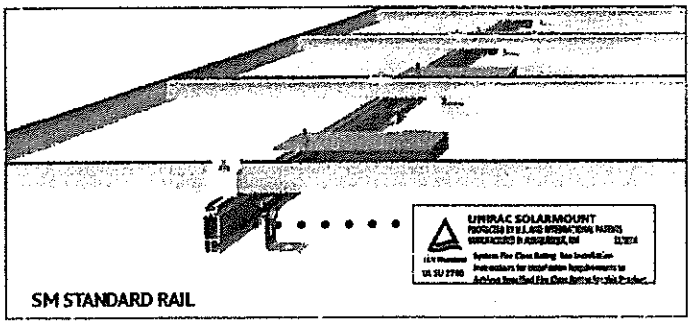
SYSTEM LEVEL FIRE CLASSIFICATION

The system fire class rating requires installation in the manner specified in the SOLARMOUNT Installation Guide. SOLARMOUNT has been classified to the system level fire portion of UL 1703. This UL 1703 classification has been incorporated into our UL 2703 product certification. SOLARMOUNT has achieved system level performance for steep sloped roofs. System level fire performance is inherent in the SOLARMOUNT design, and no additional mitigation measures are required. The fire classification rating is only valid on roof pitches greater than 2:12 (slopes ≥ 2 inches per foot, or 9.5 degrees). There is no required minimum or maximum height limitation above the roof deck to maintain the system fire rating for SOLARMOUNT. Module Types & System Level Fire Ratings are listed below:

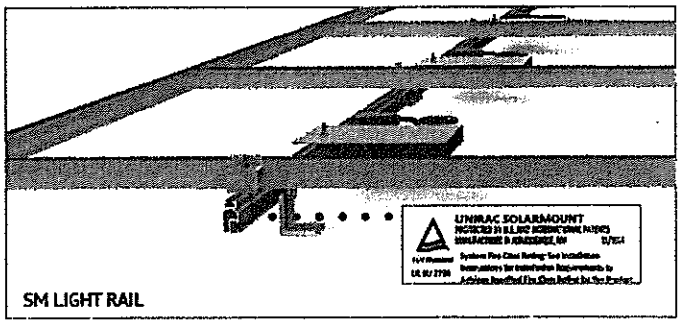
Rail Type	Module Type	System Level Fire Rating	Rail Direction	Module Orientation	Mitigation Required
Standard Rail	Type 1, Type 2, Type 3 & Type 10	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required
Light Rail	Type 1 & Type 2	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required

UL2703 CERTIFICATION MARKING LABEL

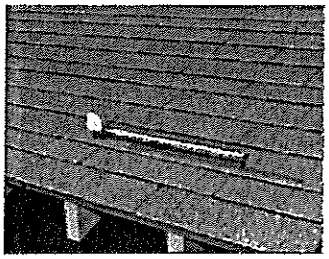
Unirac SOLARMOUNT is listed to UL 2703. Marking Labels are shipped with the Midclamps. After the racking system is fully assembled, a single Marking Label should be applied to the SOLARMOUNT rail at the edge of the array. Note: The sticker label should be placed such that it is visible, but not outward facing.



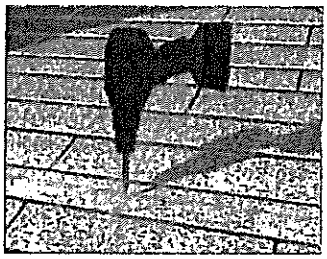
SM STANDARD RAIL



SM LIGHT RAIL



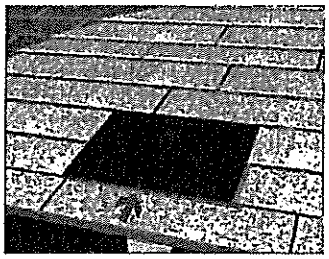
ROOF PREPARATION: Layout and install flashing at rafter locations determined per Design and Engineering Guide.



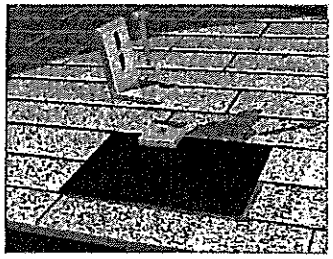
DRILL PILOT HOLES: Center the roof attachment over the rafter and drill a pilot hole(s) for the lag bolt(s).

NOTE: Determine lag bolt size and embedment depth.

Quick Tip: Pre-drill the pilot hole through the flat flashing lag bolt location for easier installation

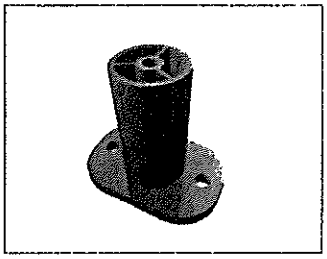


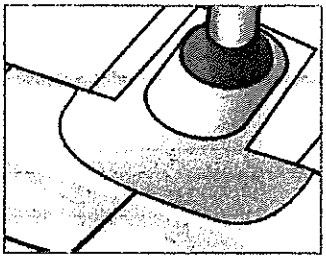
FLAT FLASHING INSTALLATION: Insert the Flat Flashing so the top part is under the next row of shingles and the hole lines up with the pilot hole.



INSTALL LAG BOLTS & L-FOOT: Insert the lag bolt through the L-Foot in the order shown in the illustration. Verify proper orientation before tightening lag bolts.

See Unirac Flat Flashing Manual for Additional Details.

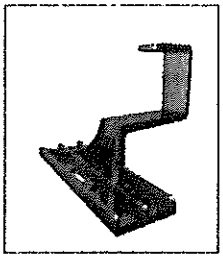


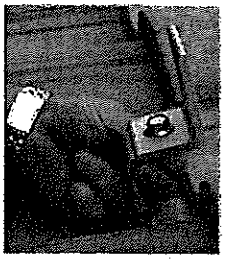


2 PIECE ALUMINUM STANDOFF WITH FLASHING & L-FOOT:

- If necessary cut an opening in the roofing material over a rafter to accommodate the flashing riser.
- Install the standoff, ensuring that both lag bolts are screwed into the rafter.
- Insert the flashing under the shingle above and over the shaft of the standoff. (No-Calk™ collar does not require sealing of the flashing and standoff shaft)
- Add L-Foot to top with bolt that secures the EPDM washer to the top of the standoff.

See Standoffs & Flashings Installation Manual 907.2 for Additional Details.

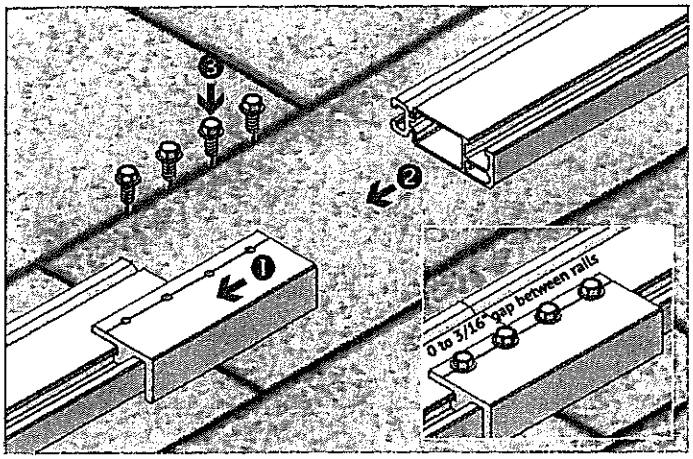




TOP MOUNT TILE HOOK & L-FOOT:

- Remove or slide up the roof tile, position the roof hook above the roof rafter
- Place Tile Hook in the middle of the underlying interlocking tile's valley. Drill 3/16 inch pilot holes through the underlayment into the center of the rafters. Securely fasten each tile hook to the rafters with two 5/16" x 3½" lag screws. Slide down or re-insert the tile.
- Attach L Foot to tile roof hook.

See Tile Hook Universal Mount Installation Manual for Additional Information.



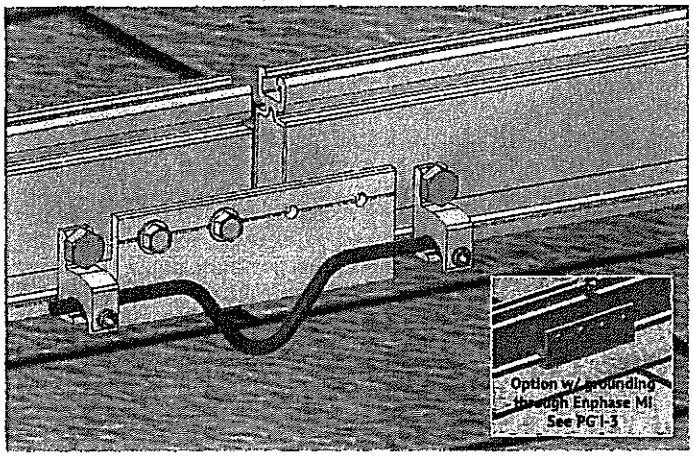
SPLICE INSTALLATION (IF REQUIRED PER SYSTEM DESIGN)

If your installation uses SOLARMOUNT splice bars, attach the rails together before mounting to the L-feet / footings. Use splice bars only with flush installations or those that use low-profile tilt legs. A rail should always be supported by more than one footing on both sides of the splice. There should be a gap between rails, up to 3/16" at the splice connections. T-bolts should not be placed less than a distance of 1" from the end of the rail regardless of a splice.

TORQUE VALUE (See Note on PG. A)

Hex head socket size 5/16" - Do not exceed 10 ft-lbs. Do not use Anti-Seize.

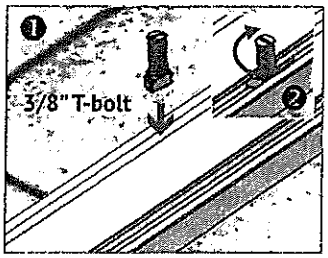
Max length of spliced rail is 40 ft. An expansion joint is required > 40 ft.



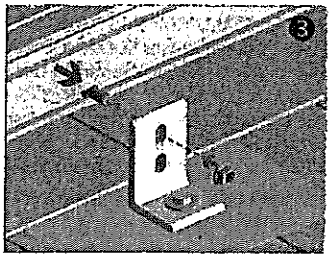
EXPANSION JOINT USED AS THERMAL BREAK

Expansion joints prevent buckling of rails due to thermal expansion. Splice bars may be used for thermal expansion joints. To create a thermal expansion joint, slide the splice bar into the footing slots of both rail lengths. Leave approximately ½" between the rail segments. Secure the splice bar with two screws on one side only. Footings (such as L-feet or standoffs) should be secured normally on both sides of the splice. No PV module or mounting hardware component should straddle the expansion joint. Modules must clearly end before the joint with mounting hardware (top mount Endclamps) terminating on that rail. T-bolts should not be placed less than a distance of 1" from the end of the rail regardless of a splice. The next set of modules would then start after the splice with mounting hardware beginning on the next rail. **A thermal break is required every 40 feet of continuously connected rail. For additional concerns on thermal breaks in your specific project, please consult a licensed structural engineer. Runs of rail less than 40 feet in length, with more than two pairs spliced together, are an acceptable installation for the SOLARMOUNT systems.**

Bonding connection for splice used as a thermal break. Option shown uses two Ilsco lugs (Model No. GBL-4DBT P/N GBL-4DBT - see product data sheet for more details) and solid copper wire.

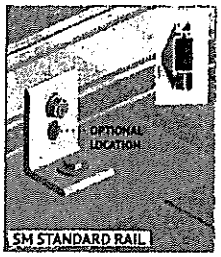


PLACE T-BOLT INTO RAIL & SECURE BOLT: Insert 3/8" T-bolt into rail at L-foot locations. Apply Anti-Seize to bolt. Rotate T-bolt into position.

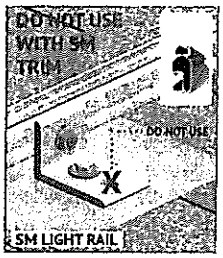


SECURE T-BOLT: Apply Anti-Seize to bolt. Rotate T-bolt into position.

Note:
Allowable L-foot slot locations for SM Standard & Light Rail.



SM STANDARD RAIL: Use either slot to connect the L-foot to the rail to obtain the desired height and alignment when using SM Standard rail.



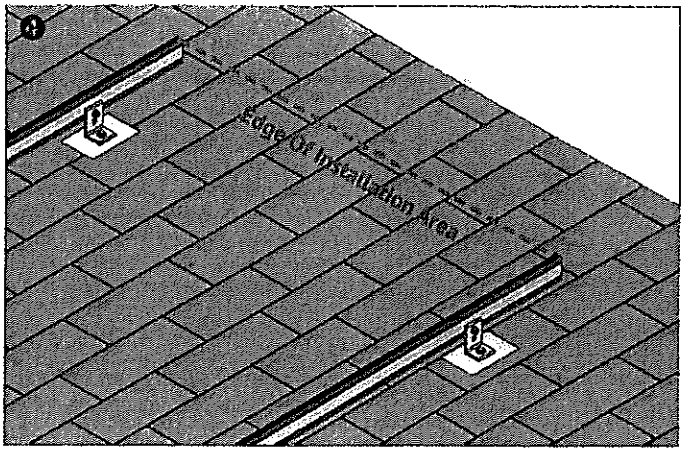
SM LIGHT RAIL: For a lower profile array when using SM Light rail, rotate the L-foot to orient the side with only one (1) slot against the rail. **Only use the slot location closet to the rail to connect the lag bolt to the flashing / roof on the side with two (2) slots.**

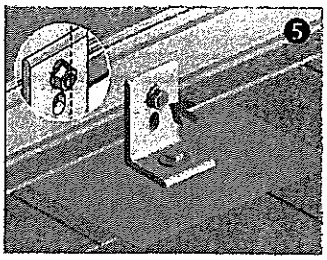
NOTE: Use only the top slot to connect the L-foot to the rail to obtain the desired height and alignment when using SM Light rail.

ALIGN RAILS: Align one pair of rail ends to the edge of the installation area. The opposite pair of rail ends will overhang installation area. Do not Trim them off until the installation is complete. If the rails are perpendicular to the rafters, either end of the rails can be aligned, but the first module must be installed at the aligned end.

If the rails are parallel to the rafters, the aligned end of the rails must face the lower edge of the roof. Securely tighten all hardware after alignment is complete.

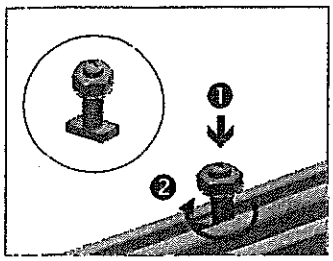
Mount modules to the rails as soon as possible. Large temperature changes may bow the rails within a few hours if module placement is delayed.



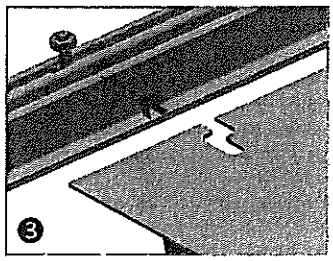


ALIGN POSITION INDICATOR: Hand tighten nut until rail alignment is complete. Verify that position indicator on bolt is vertical (perpendicular to rail)

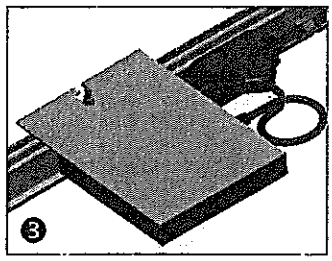
TORQUE VALUE (See Note on PG. A)
3/8" nut to 30 ft-lbs



INSTALL MICROINVERTER MOUNT T-BOLT: Apply Anti-Seize and install pre-assembled ¼" dia. bonding T-bolts into top ¼" rail slot at microinverter locations. Rotate bolts into position.

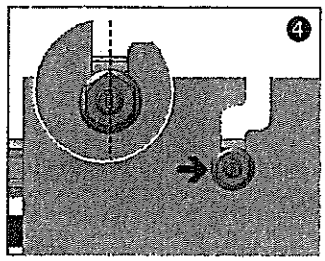


INSTALL MICROINVERTER: Install microinverter on to rail. Engage with bolt.

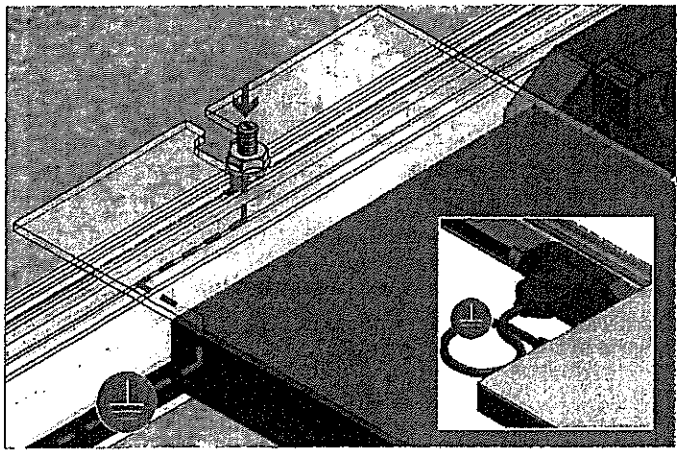


INSTALL MICROINVERTER:

TORQUE VALUE (See Note on PG. A) 1/4" nut to 10 ft-lbs w/Anti-Seize



ALIGN POSITION INDICATOR: Verify that position indicator on bolt is perpendicular to rail.



SM EQUIPMENT GROUNDING THROUGH ENPHASE MICROINVERTERS

The Enphase M215 and M250 microinverters have integrated grounding capabilities built in. In this case, the DC circuit is isolated from the AC circuit, and the AC equipment grounding conductor (EGC) is built into the Enphase Engage integrated grounding (IG) cabling.

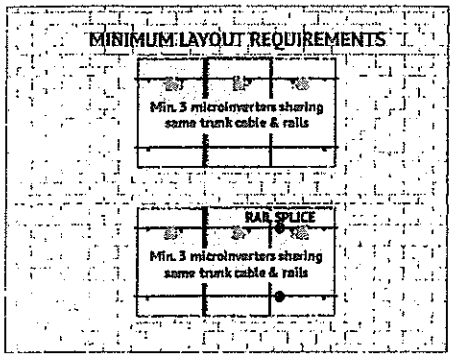
In order to ground the SOLARMOUNT racking system through the Enphase microinverter and Engage cable assembly, there must be a minimum of three PV modules connected to the same trunk cable within a continuous row. Continuous row is defined as a grouping of modules installed and bonded per the requirements of this installation guide sharing the same two rails. The microinverters are bonded to the SOLARMOUNT rail via the mounting hardware. Complete equipment grounding is achieved through the Enphase Engage cabling with integrated grounding (IG). No additional EGC grounding cables are required, as all fault current is carried to ground through the Engage cable.

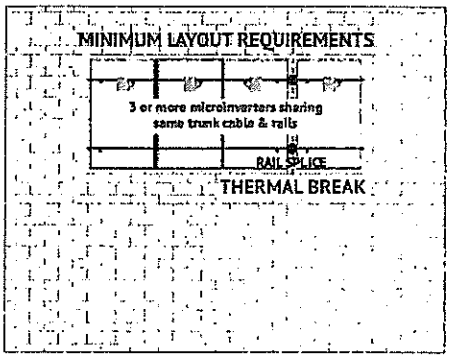
SOLARMOUNT INTEGRATED BONDING ADVANTAGE

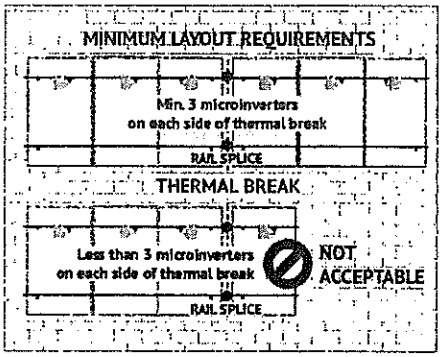
LOSE ALL THE COPPER & LUGS

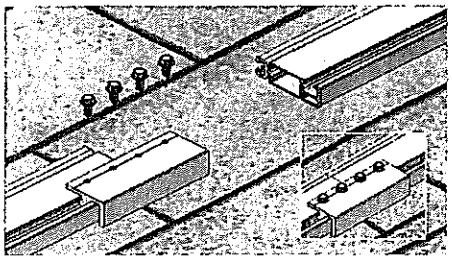
31

CONTINUOUS RAIL & ELECTRICAL BONDING SPLICE	EXPANSION JOINT W/ GROUNDING LUGS & COPPER JUMPER	EXPANSION JOINT W/O ELECTRICAL BONDING CONNECTION
Enphase Microinverter (MI) Requirements (Model No. M215 & M250)	Enphase Microinverter (MI) Requirements (Model No. M215 & M250)	Enphase Microinverter (MI) Requirements (Model No. M215 & M250)
3 Microinverters sharing same trunk cable & rails	3 or more Microinverters sharing same trunk cable & rails	Min. 3 Microinverters on each side of thermal break

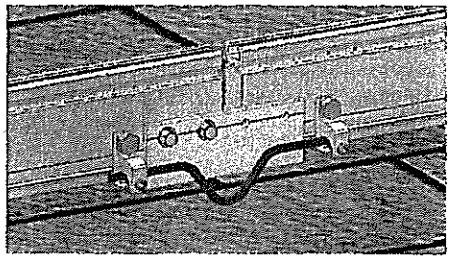




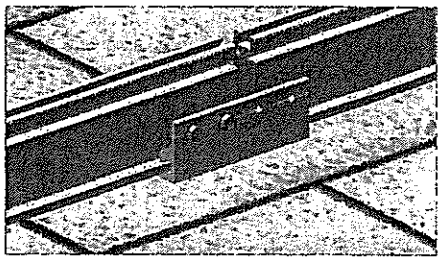




ELECTRICAL BONDING SPLICE



EXPANSION JOINT USED AS THERMAL BREAK W/ GROUNDING LUGS & COPPER JUMPER



EXPANSION JOINT USED AS THERMAL BREAK W/O ELECTRICAL BONDING CONNECTION

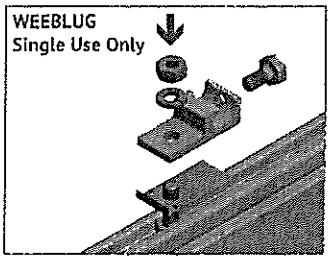
NOTE: THE ABOVE IMAGES ARE SAMPLE CONFIGURATIONS TO ILLUSTRATE THE REQUIREMENTS FOR SM SYSTEM GROUNDING THROUGH ENPHASE MICROINVERTERS DESCRIBED ON PAGE I-2

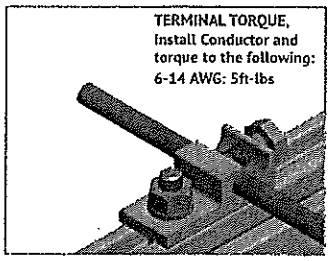
ONLY ONE LUG PER ROW OF MODULES:
Only one lug per row of modules is required. See Page F for additional lugs required for expansion joints.

GROUNDING LUG MOUNTING DETAILS:
Details are provided for both the WEEB and Ilsco products. The WEEBLug has a grounding symbol located on the lug assembly. The Ilsco lug has a green colored set screw for grounding indication purposes. Installation must be in accordance with NFPA NEC 70, however the electrical designer of record should refer to the latest revision of NEC for actual grounding conductor cable size.
Required if not using approved integrated grounding microinveters

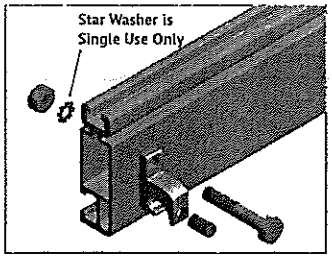
GROUNDING LUG - BOLT SIZE & DRILL SIZE		
GROUND LUG	**BOLT SIZE**	**DRILL SIZE**
WEEBLug	1/4"	N/A - Place in Top SM Rail Slot
ILSCO Lug	#10-32	7/32"

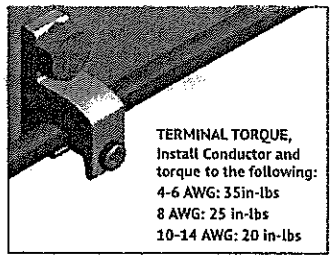
- Torque value depends on conductor size.
- See product data sheet for torque value.





WEEBLUG CONDUCTOR - UNIRAC P/N 008002S:
Apply Anti Seize and insert a bolt in the aluminum rail and through the clearance hole in the stainless steel flat washer. Place the stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Place the lug portion on the bolt and stainless steel flat washer. Install stainless steel flat washer, lock washer and nut. Tighten the nut until the dimples are completely embedded into the rail and lug.
TORQUE VALUE 10 ft lbs. (See Note on PG. A)
See product data sheet for more details, Model No. WEEB-LUG-6.7

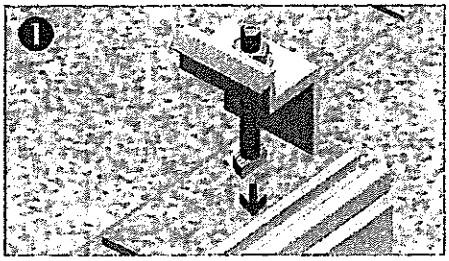




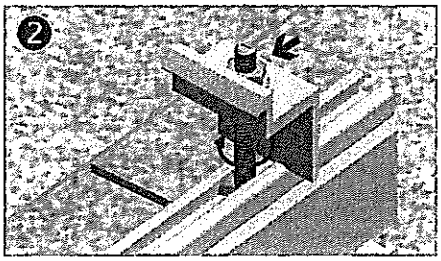
ILSCO LAY-IN LUG CONDUCTOR - UNIRAC P/N 008009P: Alternate Grounding Lug - Drill, deburr hole and bolt thru both rail walls per table.
TORQUE VALUE 5 ft lbs. (See Note on PG. A)
See ILSCO product data sheet for more details, Model No. GBL-4DBT.

NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION

INSTALL MODULE ENDCLAMPS: The Endclamp is supplied as an assembly with a T-bolt, serrated flange nut, and washer. The washer retains the clamp at the top of the assembly. This will enable the clamp to remain upright for module installation.

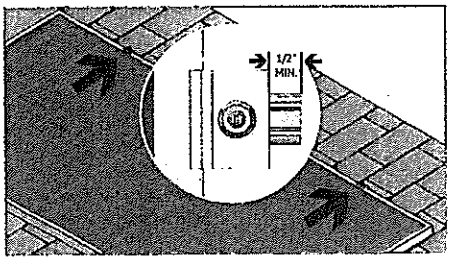


INSERT ENDCLAMP T-BOLT: Insert 1/4" T-bolt into rail.



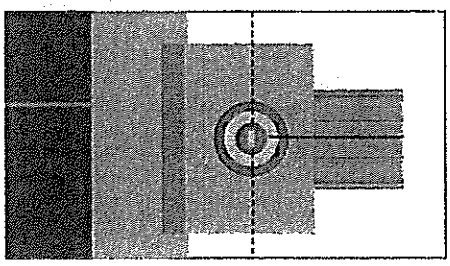
ROTATE ENDCLAMP T-BOLT: Rotate T-bolt into position. Verify that the position indicator & T-bolt shaft are angled in the correct position.

End clamps are positioned on rails prior to the first end module and installed after the last end module.



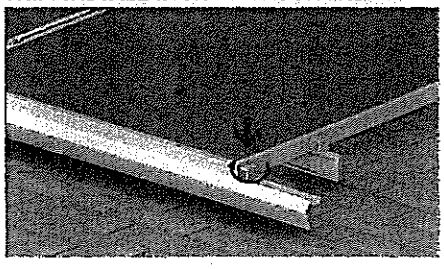
INSTALL FIRST MODULE: Install the first end module onto rails. Engage module frame with Endclamps. Verify that the position indicator & T-bolt shaft are angled in the correct position.

TORQUE VALUE (See Note on PG. A) 1/4" nuts to 10 ft-lbs. w/Anti Seize



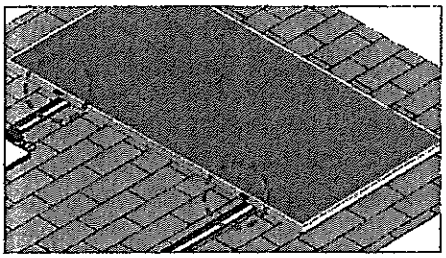
POSITION INDICATOR - SERRATED T-BOLT: Verify the T-bolt position indicator is perpendicular to the rail.

TRIM INSTALLATION INSTRUCTIONS

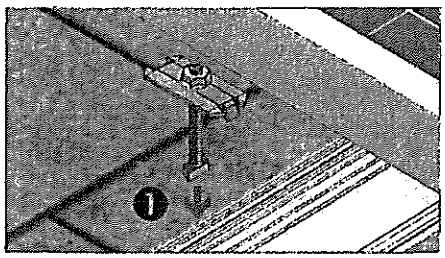


TRIM ENDCLAMPS: Install Endclamps on Trim in like manner to module endclamps per install instructions above.

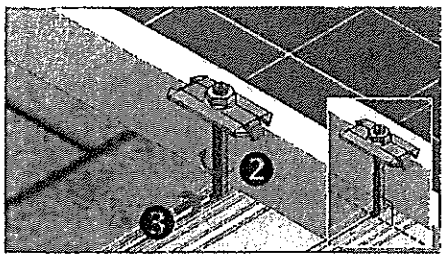
TORQUE VALUE (See Note on PG. 1)
1/4" nuts to 10 ft-lbs w/ Anti Seize



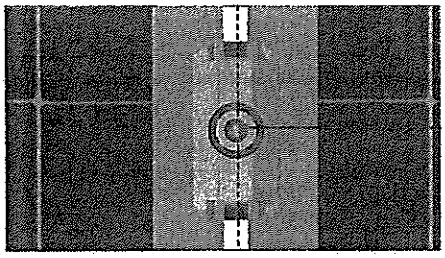
INSTALL MIDCLAMPS: Midclamp is supplied as an assembly with a T-bolt for module installation. Clamp assemblies may be positioned in rail near point of use prior to module placement.



INSERT MIDCLAMP T-BOLT: Apply Anti-Seize and insert 1/4" T-bolt into rail.

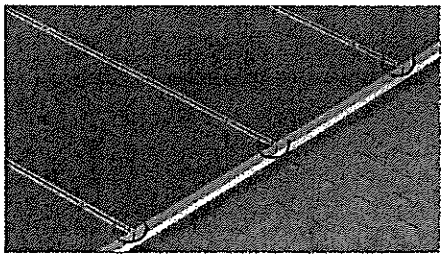


ROTATE MIDCLAMP T-BOLT: Rotate bolt into position and slide until bolt and clamp are against module frame. Do not tighten nut until next module is in position. Verify that the position indicator & T-bolt shaft are angled in the correct position.



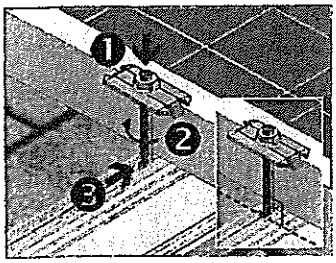
POSITION INDICATOR - SERRATED T-BOLT: Verify the T-bolt position indicator is perpendicular to the rail.

TRIM INSTALLATION INSTRUCTIONS



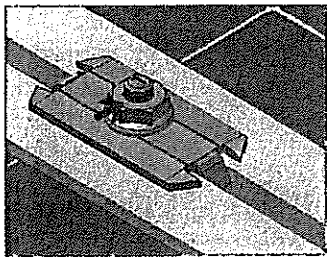
TRIM MIDCLAMPS: Ensure Trim lip is in contact with module face and verify alignment marks on T-bolts are in proper position, tighten midclamp on Trim, repeat at each gap between modules.

TORQUE VALUE (See Note on PG. 1)
1/4" nuts to 10 ft-lbs w/ Anti Seize



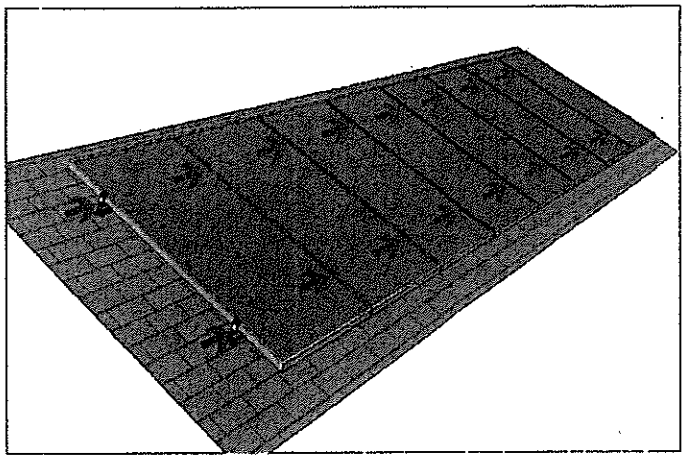
INSTALL REMAINING MID-CLAMPS: Proceed with module installation. Engage each module with previously positioned Midclamp assemblies.

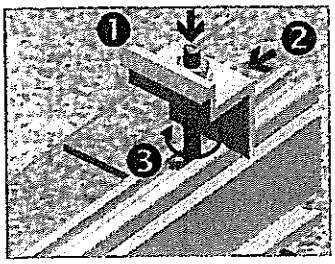
NOTE: Apply Anti-Seize to each Mid Clamp prior to installation.



POSITION T-BOLT ALIGNMENT MARKS: Verify that the position indicator(s) & T-bolt shaft(s) are angled in the correct position.

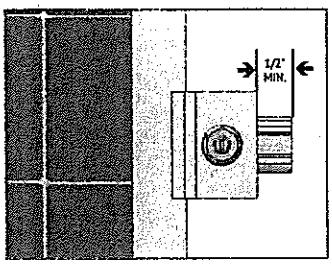
TORQUE VALUE (See Note on PG. A) 1/4" nuts to 10 ft-lbs. w/Anti Seize





INSTALL ENDCLAMPS: Apply Anti-Seize and install final Endclamps in same manner as first Endclamps. Slide clamps against module.

TORQUE VALUE (See Note on PG. A) 1/4" nuts to 10 ft-lbs. w/Anti Seize

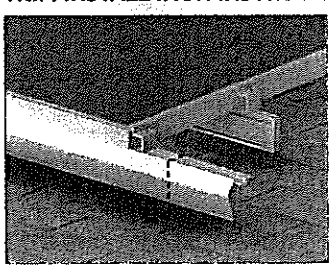


POSITION T-BOLT ALIGNMENT MARKS & CUT RAIL: Verify that the position indicator(s) & T-bolt shaft(s) are angled in the correct position. Trim off any excess rail, being careful not to cut into the roof. Allow ½" between the Endclamp and the end of the rail.

FINISH MODULE INSTALLATION: Proceed with module installation. Engage each module with the previously positioned clamp assembly:

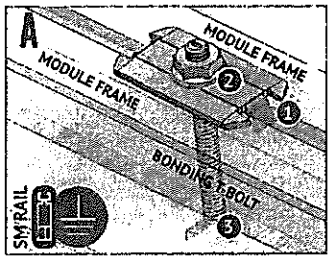
- Install second module
- Install remaining Midclamps & modules & position alignment marks
- Install Endclamps & position alignment marks
- Cut rail to desired length

TRIM INSTALLATION INSTRUCTIONS



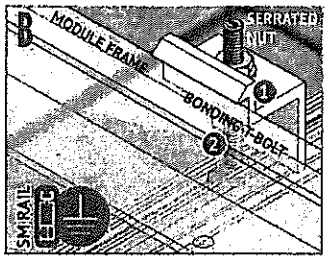
FINISH TRIM INSTALLATION, INSTALL ENDCLAMP & CUT EXCESS RAIL: Install final endclamp & Cut away excess Trim at end of array or where required for proper cantilevers. See **D&E Guide or U-Builder for allowable cantilevers.**

TORQUE VALUE (See Note on PG. 1) 1/4" nuts to 10 ft-lbs w/ Anti Seize



BONDING MIDCLAMP ASSEMBLY

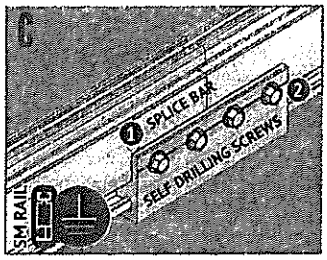
1. Stainless steel Midclamp points, 2 per module, pierce module frame anodization to bond module to module through clamp.
2. Serrated flange nut bonds stainless steel clamp to stainless steel T-bolt
3. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, clamp, and modules to grounded SM rail.



ENDCLAMP ASSEMBLY

1. Serrated flange nut bonds aluminum Endclamp to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and Endclamp to grounded SM rail

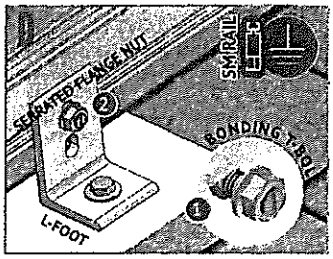
Note: End clamp does not bond to module frame.



BONDING RAIL SPLICE BAR

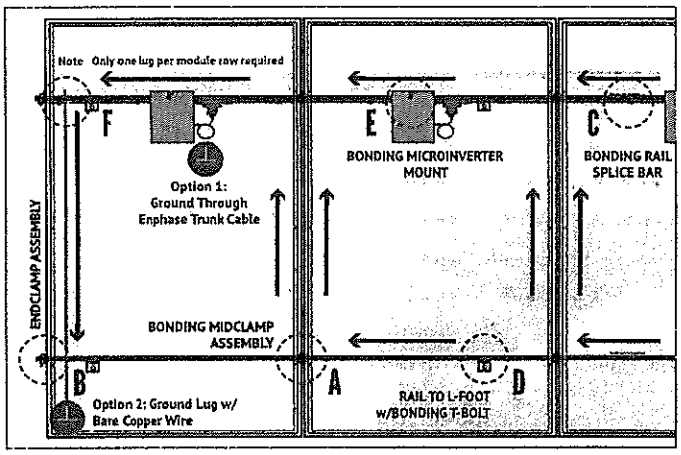
1. Stainless steel self drilling screws drill and tap into splice bar and rail creating bond between splice bar and each rail section
2. Aluminum splice bar spans across rail gap to create rail to rail bond. Rail on at least one side of splice will be grounded.

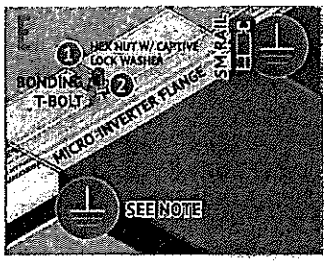
Note: Splice bar and bolted connection are non-structural. The splice bar function is rail alignment and bonding.



RAIL TO L-FOOT w/BONDING T-BOLT

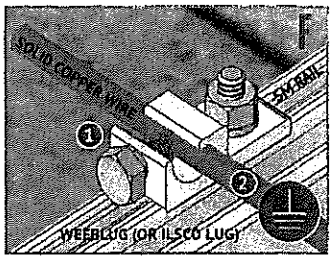
1. Serrated flange nut removes L-foot anodization to bond L-Foot to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail





BONDING MICROINVERTER MOUNT

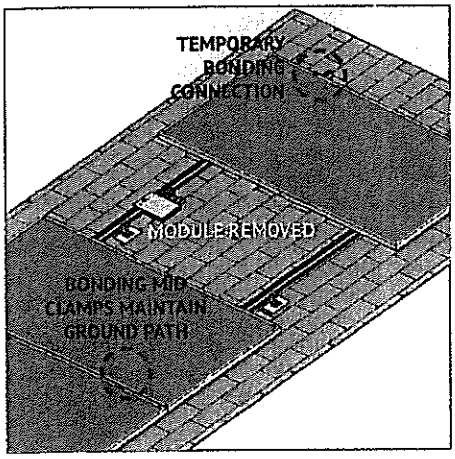
1. Hex nut with captive lock washer bonds metal microinverter flange to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail System ground including racking and modules may be achieved through the trunk cable of approved microinverter systems. See page I for details

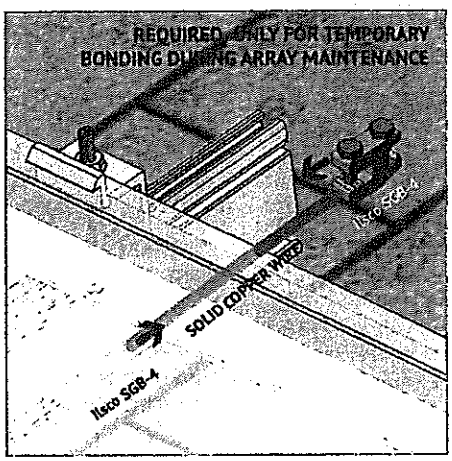


RACK SYSTEM GROUND

1. WEEB washer dimples pierce anodized rail to create bond between rail and lug
2. Solid copper wire connected to lug is routed to provide final system ground connection.

NOTE: Ilsco lug can also be used when secured to the side of the rail. See page I-3 for details





TEMPORARY BONDING CONNECTION DURING ARRAY MAINTENANCE
When removing modules for replacement or system maintenance, any module left in place that is secured with a bonding Midclamp will be properly grounded. If a module adjacent to the end module of a row is removed or if any other maintenance condition leaves a module without a bonding mid clamp, a temporary bonding connection must be installed as shown

- Attach Ilsco SGB4 to wall of rail
- Attach Ilsco SGB4 to module frame
- Install solid copper wire jumper to Ilsco lugs

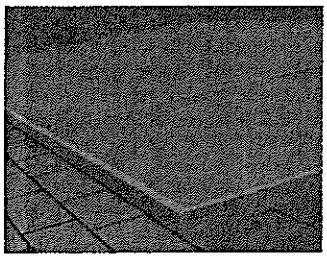
ELECTRICAL CONSIDERATIONS
SOLARMOUNT is intended to be used with PV modules that have a system voltage less than or equal to 1000 VDC. For standard system grounding a minimum 10AWG, 105°C copper grounding conductor should be used to ground a 1000 VDC system, according to the National Electric Code (NEC). It is the installer's responsibility to check local codes, which may vary. See below for interconnection information.

INTERCONNECTION INFORMATION
There is no size limit on how many SOLARMOUNT & PV modules can be mechanically interconnected for any given configuration, provided that the installation meets the requirements of applicable building and fire codes.

GROUNDING NOTES
The installation must be conducted in accordance with the National Electric Code (NEC) and the authority having jurisdiction. Please refer to these resources in your location for required grounding lug quantities specific to your project.

The grounding / bonding components may overhang parts of the array so care must be made when walking around the array to avoid damage.

Conductor fastener torque values depend on conductor size. See product data sheets for correct torque values.



PREPARATION: At front edge of array, ensure at least 3.25 inches of space between modules and roof surface and that modules are aligned to within 3/8". Plan for Trim length so that Endclamps can be properly installed.

1ST MIDCLAMP: Position Trim in front of array. Insert Midclamp into the Trim slot, aligned with the gap between the 1st two modules at either end of array.

NOTE: Apply Anti-Seize to Each Mid-Clamp prior to installation

MOUNT TRIM: Position Trim beneath modules by sliding T-bolt into gap between modules and tighten. Midclamp should stay in position and support Trim. Tighten snugly enough so that Trim is held firmly in place.

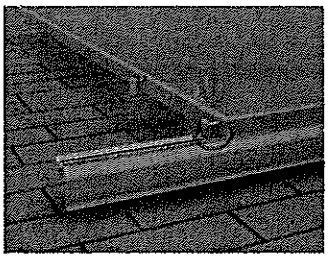
TORQUE VALUE: Do not exceed specified torque value (10 ft-lbs)

CLEAR T-BOLT SLOT: Rotate unattached end of Trim out and away from array so T-bolt slot (at next T-bolt insertion point) is clear of modules. This may require force to deflect the Trim slightly. Deflect only enough to insert T-bolt.

INSERT MIDCLAMPS: Insert T-bolt into slot and slide clamp (rotating Trim) into position between modules and leave loose. Continue to work down array, inserting Midclamps and positioning in gaps between modules.

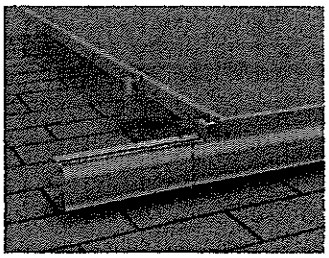
FASTEN MIDCLAMPS: Return to each inserted Midclamp. Ensuring Trim lip is in contact with module face and verifying alignment marks on T-bolts are in proper position, tighten clamp.

TORQUE VALUE (See Note on PG. 1)
1/4" nuts to 10 ft-lbs w/ Anti Seize



ENDCLAMPS: Install Endclamps per previous Endclamp install instructions

TORQUE VALUE (See Note on PG. 1)
1/4" nuts to 10 ft-lbs w/ Anti Seize



CUT EXCESS TRIM: Mark excess Trim and cut at end of array or where required for proper cantilevers.