MONTGOMERY COUNTY HISTORIC PRESERVATION COMMISSION
STAFF REPORT

Address:	310 Market St., Brookeville	**Meeting Date:**	5/10/17
Resource:	Outstanding Resource **Brookville Historic District**	**Report Date:**	5/3/17
Applicant:	Brent Cotton	**Public Notice:**	4/26/17
Review:	HAWP	**Tax Credit:**	N/A
Case Number:	23/65-17B	**Staff:**	Dan Bruechert
Proposal:	Solar Panel Installation		

STAFF RECOMMENDATION

Staff recommends that the HPC **approve** the HAWP application.

PROJECT DESCRIPTION

SIGNIFICANCE: Outstanding Resource in the Brookeville Historic District
STYLE: Gothic Revival
DATE: c. 1865

310 Market Street is a 1 ½ story side-gable, gothic revival style structure with large front and rear facing gable dormers, a central front porch with plain square columns, and a shed roof. There is an arched nine-over-four window in front-facing gable dormer and a decorative bargeboard in the eaves. The roof is covered in asphalt shingles.

The non-historic accessory structure was constructed as a two-car garage with a front gable, board and batten siding, and a 5-V metal roof. In 2005, the HPC approved modifications to the garage including the installation of the windows, doors, and re-siding the exterior to its current appearance.

PROPOSAL

The applicant is proposing to install 41 (forty-one) photovoltaic solar panels on to the house and non-contributing accessory structure. There will be 15 panels installed in three arrays on the rear of the historic house and 26 panels on the accessory structure.

APPLICABLE GUIDELINES

When reviewing alterations and new construction to a property located within a Master Plan historic district several documents are to be utilized as guidelines to assist the Commission in developing their decision. These documents include 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.

Montgomery County Code, Chapter 24A

(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;

Secretary of the Interior's Standards for Rehabilitation:

2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, space and spatial relationships that characterize a property will be avoided.
5. Distinctive materials, features, finishes and construction techniques or examples of craftsmanship that characterize a property will be preserved.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportions, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will 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

STAFF DISCUSSION

The applicant's proposal to install forty-one (41) photovoltaic panels on the property will have a minimal impact on the historic building or the surrounding district. The panels will be divided between the rear of the historic house and the non-historic accessory structure.

A total of 15 (fifteen) panels will be installed on the historic house. Those panels will be installed in three arrays placed at the rear of the house. Two sets of four panels will be installed on the rear, south-facing, slope of the roof, while another seven panels will be installed on the rear gable dormer facing west. These panels are proposed for a secondary elevation, in a location that is not visible from the public-right-of-way so as not to have a detrimental impact on the surrounding district (24A-b(2)). Additionally, this proposal will not destroy any historic material and is a reversible treatment (Standards 9 & 10).

The remaining 26 solar panels are proposed for almost total coverage to the non-historic accessory structure. The structure is a non-contributing, front gable building placed at the rear of

the lot, accessed by the driveway to the right of the historic house. Only the front gable of the structure is visible from the public right-of-way. The solar panels will be highly visible from the side of the structure; however, those facades are only visible from the rear of 310 and 312 Market St., not from the public right-of-way in the surrounding district.

While it is preferable to place the solar panels on the accessory structure or elsewhere on the site, because of the fortuitous siting of the house, the south facing panels on the historic house will not be visible from the surrounding district. The minimal visibility of the proposed solar panels complies with Chapter 24A and the Secretary for the Interior's Standards for Rehabilitation and should be approved.

STAFF RECOMMENDATION
Staff recommends the HPC **approve** the HAWP application;

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.

DPS - #8

HISTORIC PRESERVATION COMMISSION
301/563-3400

APPLICATION FOR HISTORIC AREA WORK PERMIT

Contact Email: JStokes@SolarEnergyWorld.com Contact Person: John Stokes

Daytime Phone No.: 240-281-0142

Tax Account No.: 800-731-825

Name of Property Owner: Steven Kerr Daytime Phone No.: 240-281-0142

Address: 310 (Street Number) Market St (Street) Brookeville (City) MD (State) 20833 (Zip Code)

Contractor: Solar Energy World Phone No.: 410-579-2082

Contractor Registration No.: 127353

Agent for Owner: Brent Cotton Daytime Phone No.: _____

LOCATION OF BUILDING/PREMISE

House Number: 310 Street: Market St

Town/City: Brookeville Nearest Cross Street: High St

Lot: _____ Block: _____ Subdivision: 0005

Liber: _____ Folio: _____ Parcel: P600

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: $ 34,000

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

PART TWO: COMPLETE FOR NEW CONSTRUCTION AND EXTEND/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.

Signature of owner or authorized agent

04-13-17
Date

Approved: _____ For Chairperson, Historic Preservation Commission

Disapproved: _____ Signature: _____ Date: _____

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

Edit 6/21/99

SEE REVERSE SIDE FOR INSTRUCTIONS

795993

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THE FOLLOWING ITEMS MUST BE COMPLETED AND THE REQUIRED DOCUMENTS MUST ACCOMPANY THIS APPLICATION.

1. **WRITTEN DESCRIPTION OF PROJECT**

   a. Description of existing structure(s) and environmental setting, including their historical features and significance:

   Single family dwelling and a detached shed

   b. General description of project and its effect on the historic resource(s), the environmental setting, and, where applicable, the historic district:

   install 41 roof mount solar PV panels.
   1- inverter 60 amp fused line side tap. 11.48 KW
   0 ground disturbance

2. **SITE PLAN**

   Site and environmental setting, drawn to scale. You may use your plat. Your site plan must include:

   a. the scale, north arrow, and date;

   b. dimensions of all existing and proposed structures; and

   c. site features such as walkways, driveways, fences, ponds, streams, trash dumpsters, mechanical equipment, and landscaping.

3. **PLANS AND ELEVATIONS**

   You must submit 2 copies of plans and elevations in a format no larger than 11" x 17". Plans on 8 1/2" x 11" paper are preferred.

   a. ***Schematic construction plans***, with marked dimensions, indicating location, size and general type of walls, window and door openings, and other fixed features of both the existing resource(s) and the proposed work.

   b. Elevations (facades), with marked dimensions, clearly indicating proposed work in relation to existing construction and, when appropriate, context. All materials and fixtures proposed for the exterior must be noted on the elevations drawings. An existing and a proposed elevation drawing of each facade affected by the proposed work is required.

4. **MATERIALS SPECIFICATIONS**

   General description of materials and manufactured items proposed for incorporation in the work of the project. This information may be included on your design drawings.

5. **PHOTOGRAPHS**

   a. Clearly labeled photographic prints of each facade of existing resource, including details of the affected portions. All labels should be placed on the front of photographs.

   b. Clearly label photographic prints of the resource as viewed from the public right-of-way and of the adjoining properties. All labels should be placed on the front of photographs.

6. **TREE SURVEY**

   If you are proposing construction adjacent to or within the dripline of any tree 6" or larger in diameter (at approximately 4 feet above the ground), you must file an accurate tree survey identifying the size, location, and species of each tree of at least that dimension.

7. **ADDRESSES OF ADJACENT AND CONFRONTING PROPERTY OWNERS**

   For **ALL** projects, provide an accurate list of adjacent and confronting property owners (not tenants), including names, addresses, and zip codes. This list should include the owners of all lots or parcels which adjoin the parcel in question, as well as the owner(s) of lot(s) or parcel(s) which lie directly across the street/highway from the parcel in question.

PLEASE PRINT (IN BLUE OR BLACK INK) OR TYPE THIS INFORMATION ON THE FOLLOWING PAGE.
PLEASE STAY WITHIN THE GUIDES OF THE TEMPLATE, AS THIS WILL BE PHOTOCOPIED DIRECTLY ONTO MAILING LABELS.

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
310 Market St. Brookeville, MD 20833	5681 Main St Elkridge, MD 21075
Adjacent and confronting Property Owners mailing addresses	
Mike Oestreich 308 Market St Brookeville, MD 20833	
Joanne Keister 312 Market St Brookeville, MD 20833	

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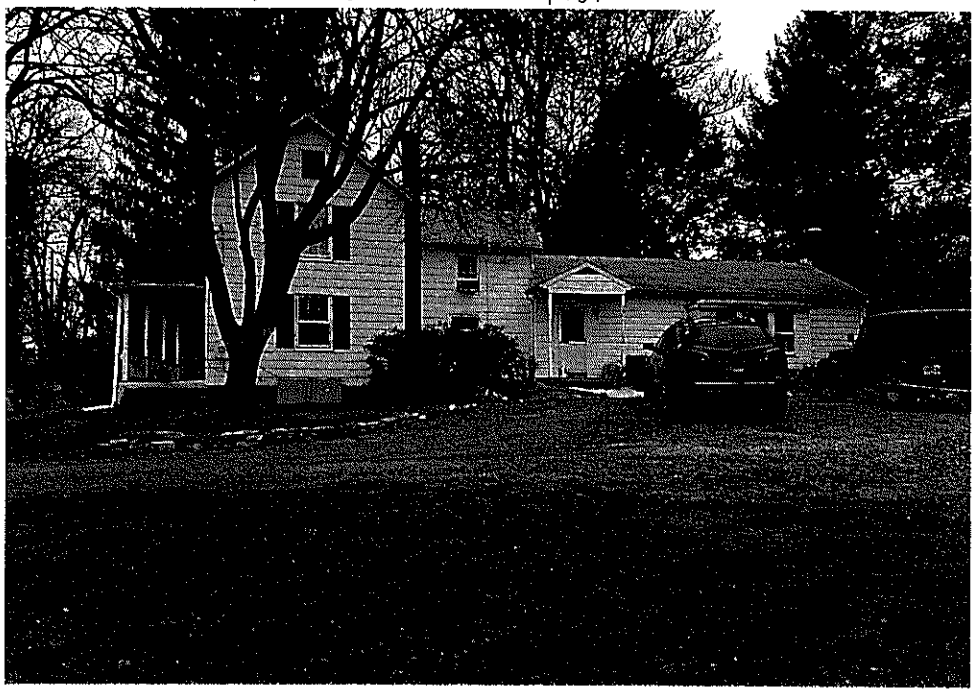
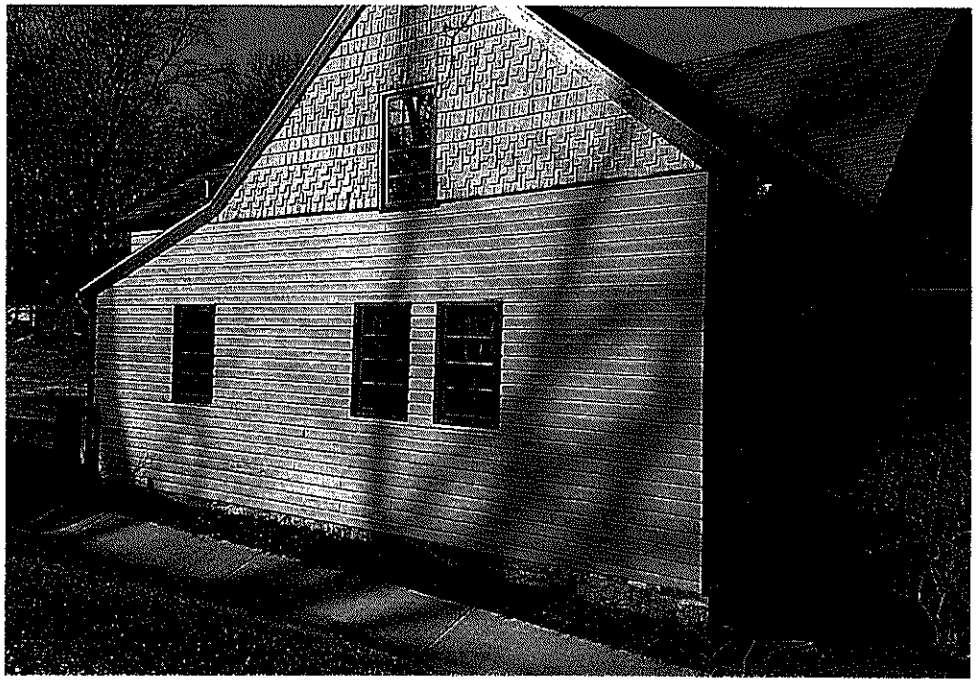
Side view of shed from 314

View of 308 from house

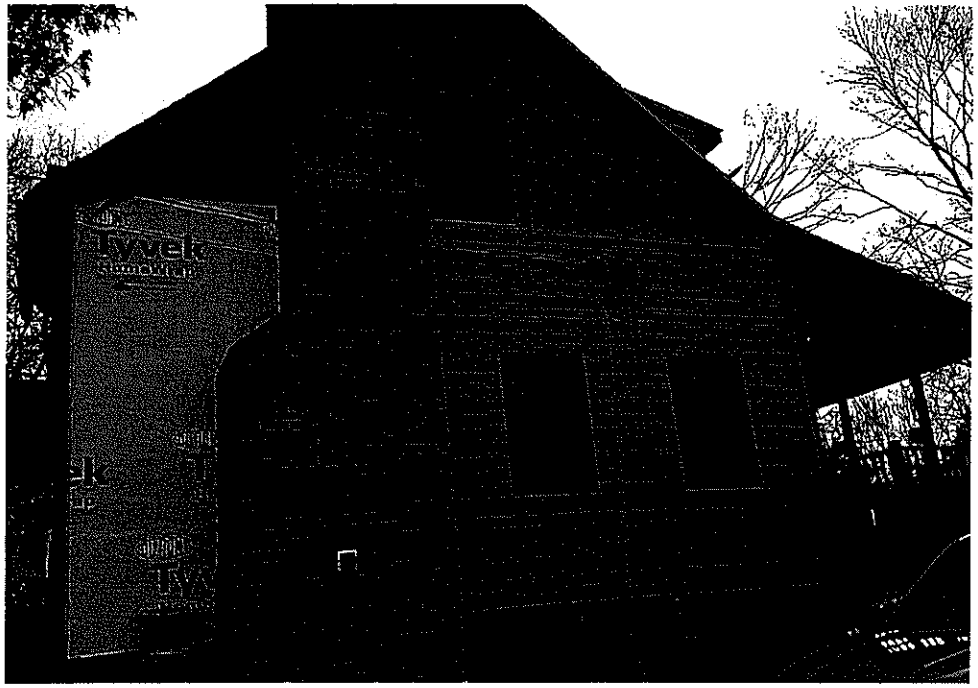


Rear view of shed and house



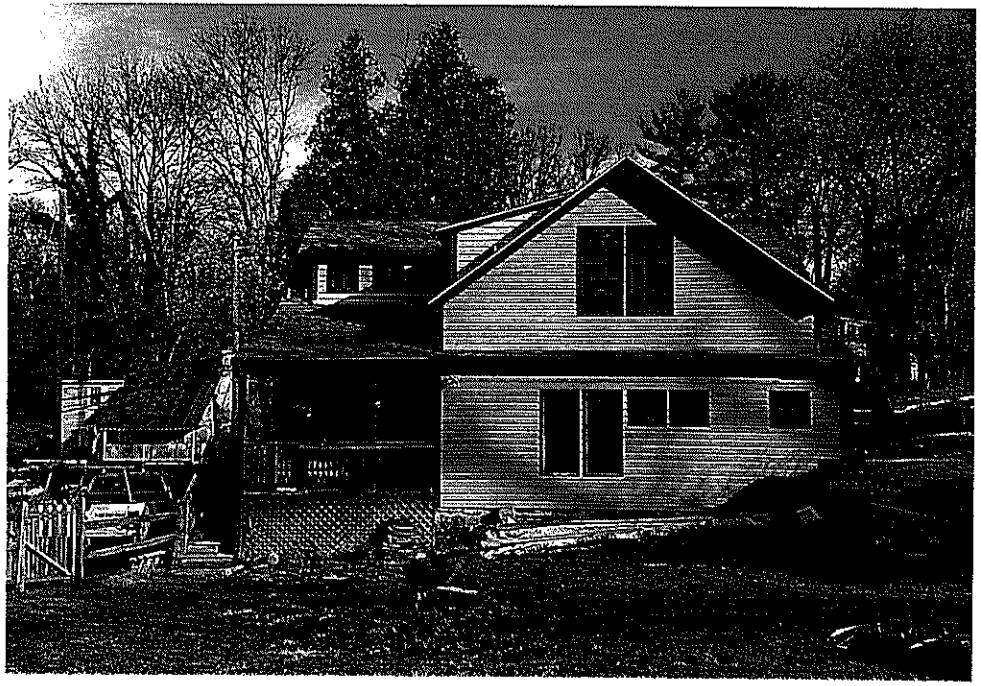
Side view of house

Side View of house



Side View of Shed

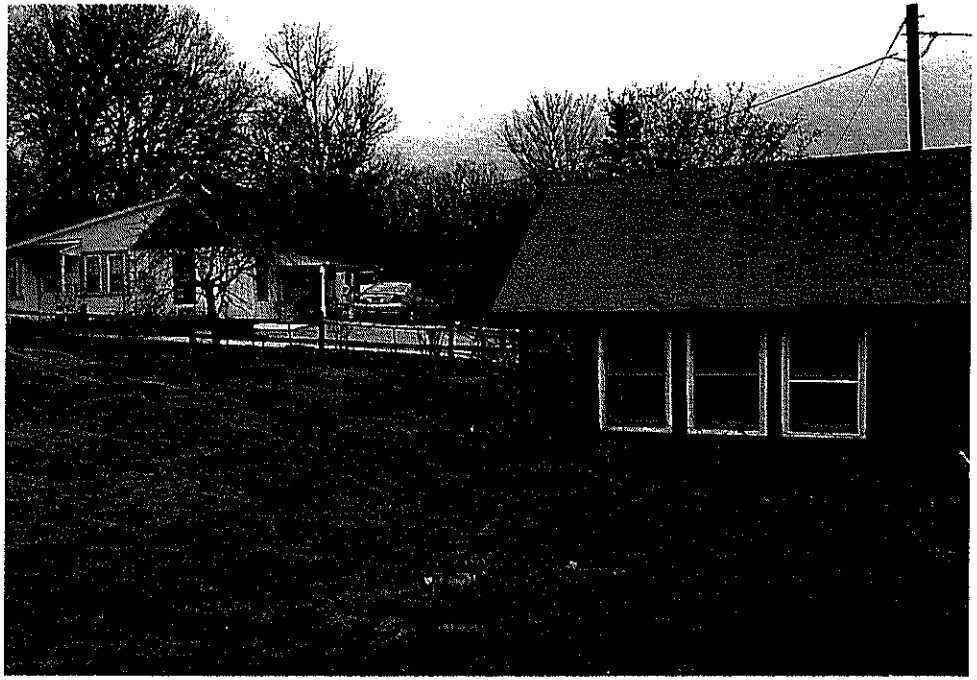
Front of house

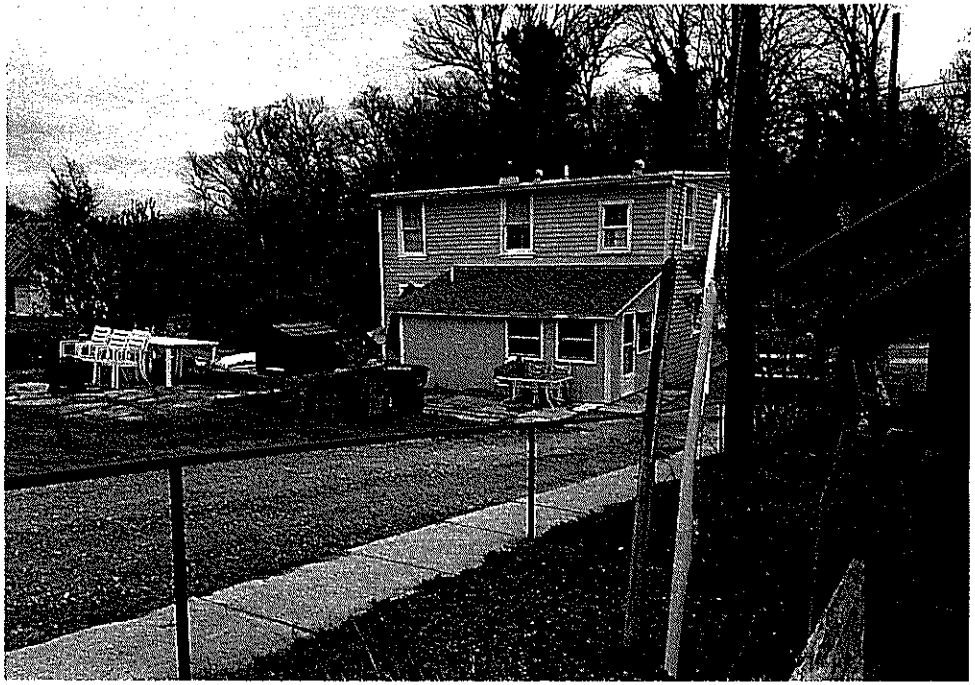


Rear view of house

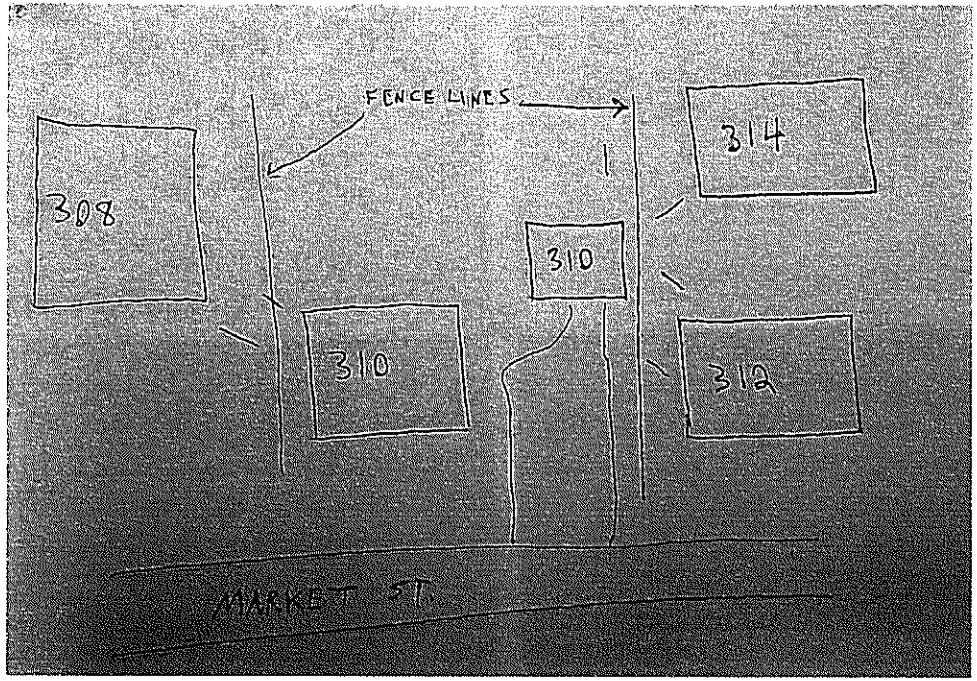
314 from POV of Shed

Shed and 314





312 from POV of Shed

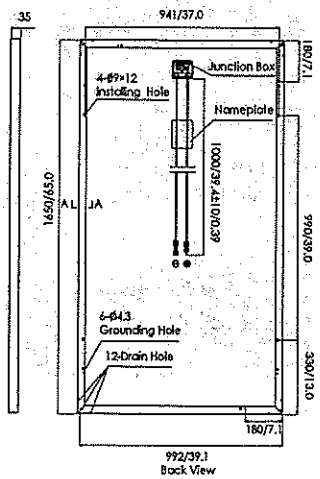


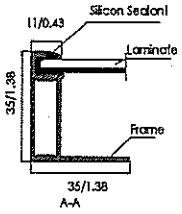
Shed and 312

THE ALLMAX™ PLUS MODULE

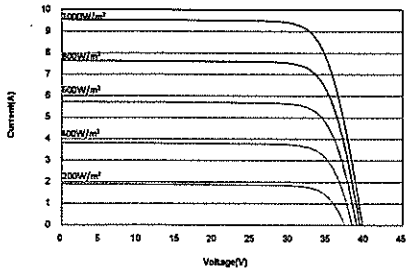
PRODUCTS	POWER RANGE
TSM-DD05A.08(II)	275-295W
TSM-DD05A.05(II)	270-290W

DIMENSIONS OF PV MODULE
unit:mm/inches

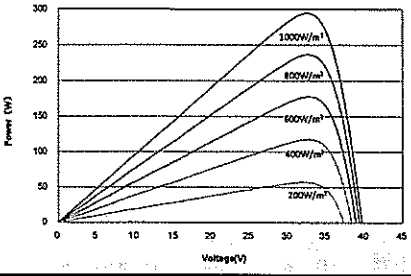




I-V CURVES OF PV MODULE(295W)



P-V CURVES OF PV MODULE(295W)



ELECTRICAL DATA (STC)

Peak Power Watts-P_{MAX} (Wp)*	270	275	280	285	290	295
Power Output Tolerance-P_{MAX} (W)	0~+5					
Maximum Power Voltage-V_{MPP} (V)	31.2	31.4	31.7	31.8	32.2	32.5
Maximum Power Current-I_{MPP} (A)	8.66	8.76	8.84	8.97	9.01	9.08
Open Circuit Voltage-Voc (V)	38.4	38.7	39.0	39.3	39.5	39.7
Short Circuit Current-Isc (A)	9.18	9.26	9.35	9.45	9.50	9.55
Module Efficiency η_m (%)	16.5	16.8	17.1	17.4	17.7	18.0

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

ELECTRICAL DATA (NOCT)

Maximum Power-P_{MAX} (Wp)	201	205	209	212	216	220
Maximum Power Voltage-V_{MPP} (V)	28.9	29.2	29.4	29.6	29.9	30.2
Maximum Power Current-I_{MPP} (A)	6.96	7.02	7.10	7.17	7.23	7.28
Open Circuit Voltage-Voc (V)	35.7	36.0	36.3	36.6	36.7	36.9
Short Circuit Current-Isc (A)	7.41	7.48	7.55	7.63	7.67	7.71

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

MECHANICAL DATA

Solar Cells	Monocrystalline 156 × 156 mm (6 inches)
Cell Orientation	60 cells (6 × 10)
Module Dimensions	1650 × 992 × 35 mm (65.0 x 39.1 x 1.38 inches)
Weight	18.6 kg (41.0 lb)
Glass	3.2 mm (0.13 inches), High Transmission, AR Coated Tempered Glass
Backsheet	White (DD05A.08(II)); Black (DD05A.05(II))
Frame	Black (DD05A.08(II), DD05A.05(II))
J-Box	IP 67 or IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm² (0.006 inches²), 1000 mm (39.4 inches)
Connector	MC4 Compatible or Amphenol H4/UTX
Fire Type	Type 1 or Type 2

TEMPERATURE RATINGS

Nominal Operating Cell Temperature (NOCT)	44°C(± 2°C)
Temperature Coefficient of P_{MAX}	- 0.39%/°C
Temperature Coefficient of Voc	- 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	15A

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

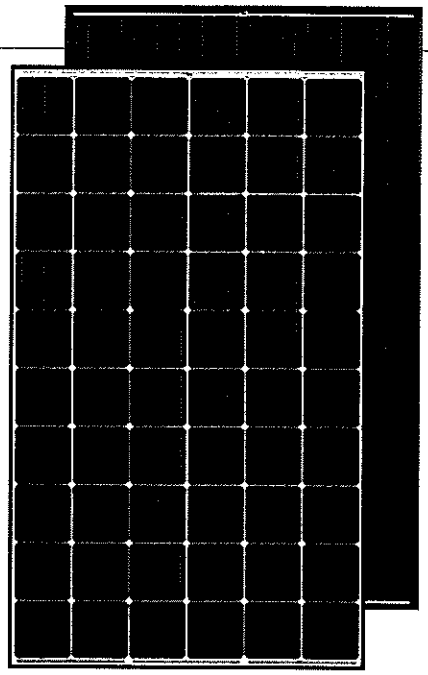
Modules per 40' container: 840 pieces

TSM_EN_2016_D

Trinasolar
Smart Energy Together

Mono Multi Solutions

THE ALLMAX M PLUS+ MODULE



60 CELL
MONOCRYSTALLINE MODULE

270-295W
POWER OUTPUT RANGE

18.0%
MAXIMUM EFFICIENCY

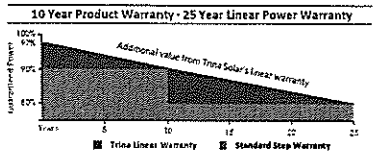
0~+5W
POSITIVE POWER TOLERANCE

As a leading global manufacturer of next generation photovoltaic products, we believe close cooperation with our partners is critical to success. With local presence around the globe, 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 as the backbone of our shared success in driving Smart Energy Together.

Trina Solar Limited
www.trinasolar.com

LINEAR PERFORMANCE WARRANTY

10 Year Product Warranty · 25 Year Linear Power Warranty



Trinasolar
Smart Energy Together

Maximize limited space with top-end efficiency

- Up to 180 W/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
- 100% EL double inspection

Certified to withstand challenging environmental conditions

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

Comprehensive products and system certificates

- IEC 61215/ IEC 61730/ UL 1703/ IEC 61701/IEC 62716
- ISO 9001: Quality Management System
- ISO 14001: Environmental Management System
- ISO 14064: Greenhouse Gases Emissions Verification
- OHSAS 18001: Occupation Health and Safety Management System

c UL us LISTED · MCS · CE · ISO · PV CYCLE

Single Phase Inverters for North America

SE3000A-US / SE3800A-US / SE5000A-US / SE6000A-US / SE7600A-US / SE10000A-US / SE11400A-US

	SE3000A-US	SE3800A-US	SE5000A-US	SE6000A-US	SE7600A-US	SE10000A- US	SE11400A-US	
OUTPUT								
Nominal AC Power Output	3000	3800	5000	6000	7600	9980 @ 208V 10000 @240V	11400	VA
Max. AC Power Output	3300	4150	5400 @ 208V 5450 @240V	6000	8350	10800 @ 208V 10950 @240V	12000	VA
AC Output Voltage Min.-Nom.-Max.[1] 183 - 208 - 229 Vac	-	-	✓	-	-	✓	-	
AC Output Voltage Min.-Nom.-Max.[1] 211 - 240 - 264 Vac	✓	✓	✓	✓	✓	✓	✓	
AC Frequency Min.-Nom.-Max.[1]	59.3 - 60 - 60.5							Hz
Max. Continuous Output Current	12.5	16	24 @ 208V 21 @ 240V	25	32	48 @ 208V 42 @ 240V	47.5	A
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							Yes
INPUT								
Maximum DC Power (STC)	4050	5100	6750	8100	10250	13500	15350	W
Transformer-less, Ungrounded	Yes							
Max. Input Voltage	500							Vdc
Nom. DC Input Voltage	325 @ 208V / 350 @ 240V							Vdc
Max. Input Current[2]	9.5	13	16.5 @ 208V 15.5 @ 240V	18	23	33 @ 208V 30.5 @ 240V	34.5	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kΩ Sensitivity							
Maximum Inverter Efficiency	97.7	98.2	98.3	98.3	98	98	98	%
CEC Weighted Efficiency	97.5	98	97 @ 208V 98 @ 240V	97.5	97.5	97 @ 208V 97.5 @ 240V	97.5	%
Nighttime Power Consumption	< 2.5					< 4		W
ADDITIONAL FEATURES								
Supported Communication Interfaces	RS485, RS232, Ethernet, ZigBee (optional)							
Revenue Grade Data, ANSI C12.1	Optional[3]							
Rapid Shutdown – NEC 2014 690.12	Yes							
STANDARD COMPLIANCE								
Safety	UL1741, UL1699B, UL1998 , CSA 22.2							
Grid Connection Standards	IEEE1547							
Emissions	FCC part15 class B							
INSTALLATION SPECIFICATIONS								
AC output conduit size / AWG range	3/4" minimum / 16-6 AWG					3/4" minimum / 8-3 AWG		
DC input conduit size / # of strings / AWG range	3/4" minimum / 1-2 strings / 16-6 AWG					3/4" minimum / 1-3 strings / 14-6 AWG		
Dimensions with Safety Switch (HxWxD)	30.5 x 12.5 x 7.2 / 775 x 315 x 184					30.5 x 12.5 x 10.5 / 775 x 315 x 260		in / mm
Weight with Safety Switch	51.2 / 23.2		54.7 / 24.7			88 .4 / 40.1		lb / kg
Cooling	Natural Convection				Natural convection and internal fan (user replaceable)	Fans (user replaceable)		
Noise	< 25				< 50			dBA
Min.-Max. Operating Temperature Range	-13 to +140 / -25 to +60 (-40 to +60 version available[4])							°F / °C
Protection Rating	NEMA 3R							

[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: SExxxxA-US000NNR2 (for 7600W inverter:SE7600A-US002NNR2).
[4] -40 version P/N: SExxxxA-US000NNU4 (for 7600W inverter:SE7600A-US002NNU4).

RoHS

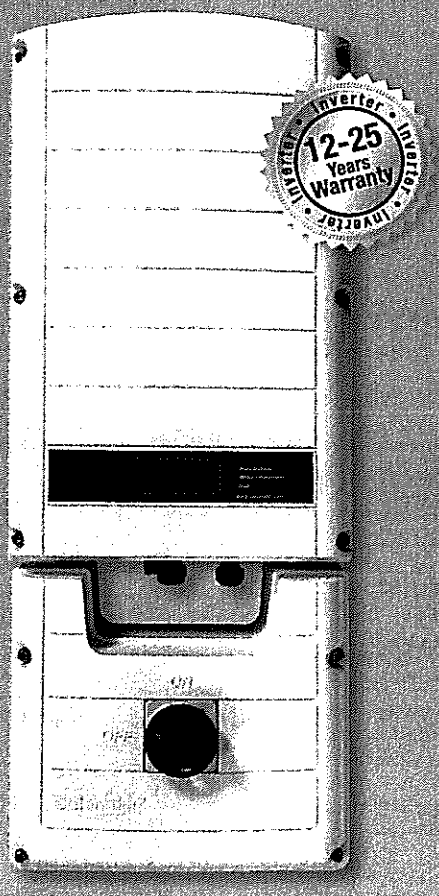
solaredge

SolarEdge Single Phase Inverters

For North America

SE3000A-US / SE3800A-US / SE5000A-US / SE6000A-US /
SE7600A-US / SE10000A-US / SE11400A-US

INVERTERS



The best choice for SolarEdge enabled systems

- Integrated arc fault protection for NEC 2011 690.11 compliance
- Rapid shutdown for NEC 2014 690.12
- Superior efficiency (98%)
- Small, lightweight and easy to install on provided bracket
- Built-in module-level monitoring
- Internet connection through Ethernet or Wireless
- Outdoor and indoor installation
- Fixed voltage inverter, DC/AC conversion only
- Pre-assembled Safety Switch for faster installation
- Optional – revenue grade data, ANSI C12.1

SM SOLAR MOUNT

INSTALLATION GUIDE

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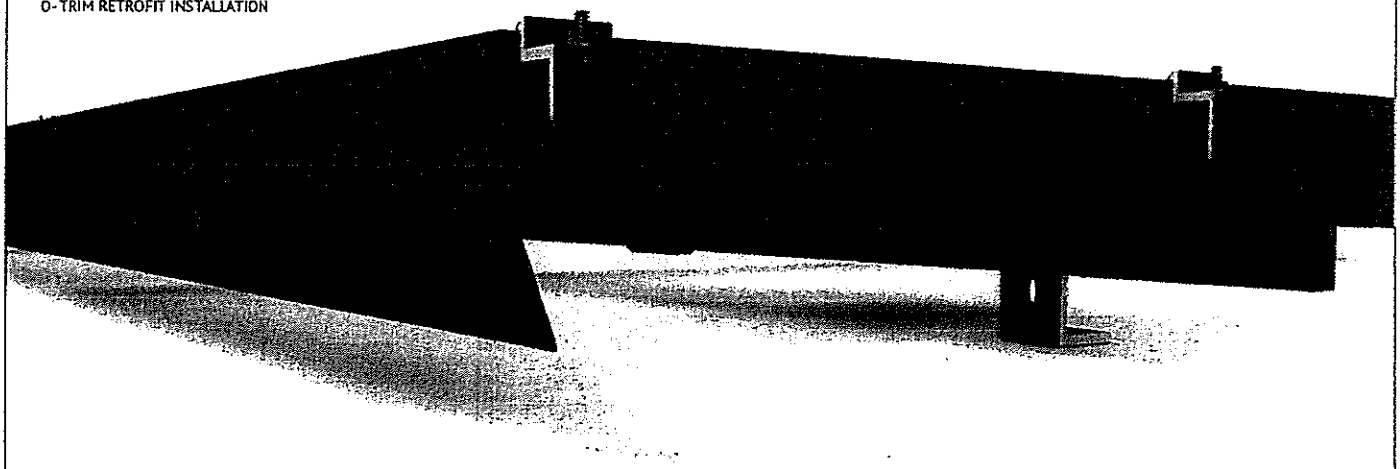

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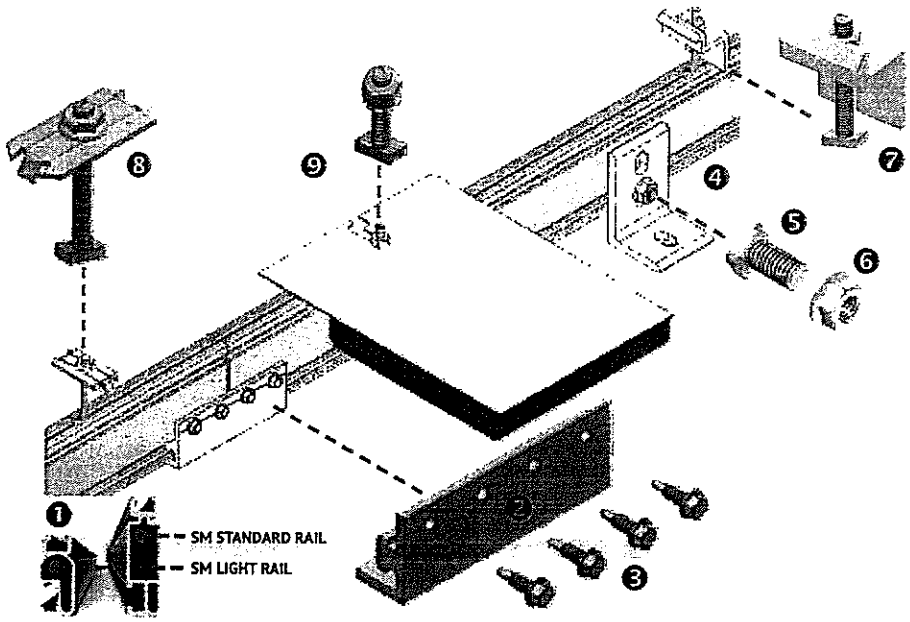


Wrenches and Torque

	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.

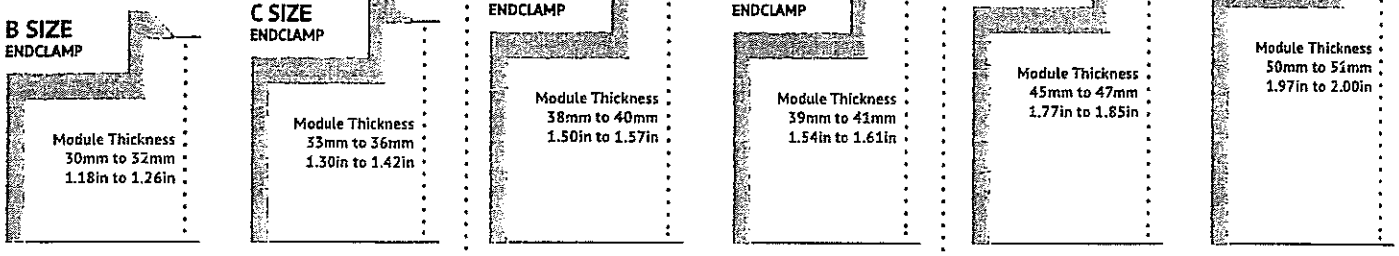
❻**SERRATED FLANGE NUT (3/8"):** Use one per L-foot to secure and bond rail to L-foot. Stainless steel. Supplied with L-foot.

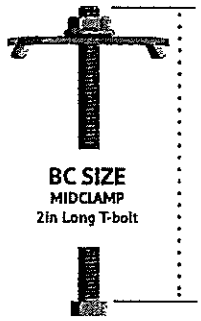
❼**MODULE ENDCLAMP:** Provides bond from rail to endclamp. Pre-assembled aluminum clamp available in clear or dark finish. Supplied washer keeps clamp and bolt upright for ease of assembly.

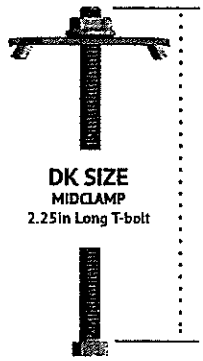
❽**MODULE MIDCLAMP:** Pre-assembled clamp provides module to module and module to rail bond. Stainless steel clamp and T-bolt. Available in clear or dark finish.

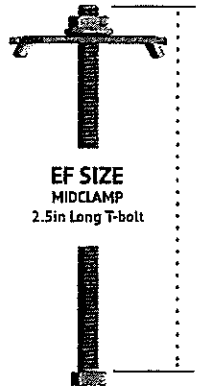
❾**MICROINVERTER MOUNTING BOLT:** Pre-assembled bolt and nut attaches and bonds microinverter to rail. Washer at base keeps bolt upright for ease of assembly.

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

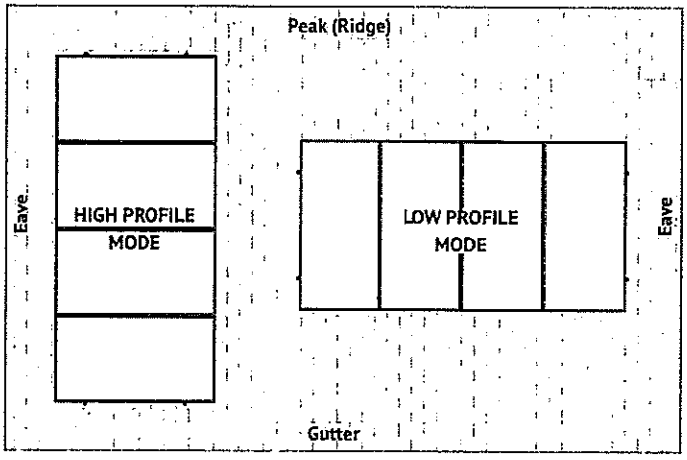
L-feet, in conjunction with proper flashing equipment and techniques, can be used for attachment through existing roofing material, such as asphalt shingles, sheathing or sheet metal to the building structure.

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.

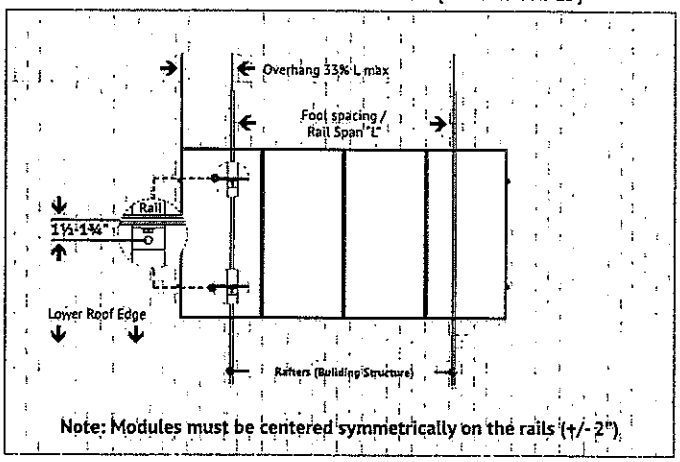
If multiple rows are to be installed adjacent to one another, it is not likely that each row will be centered above the rafters. Adjust as needed, following the guidelines below as closely as possible.

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)



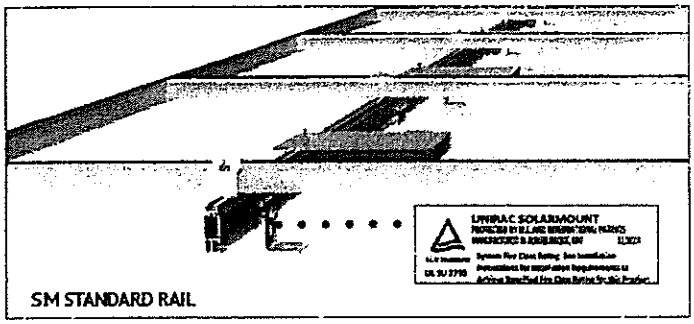
SYSTEM LEVEL FIRE CLASSIFICATION

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:

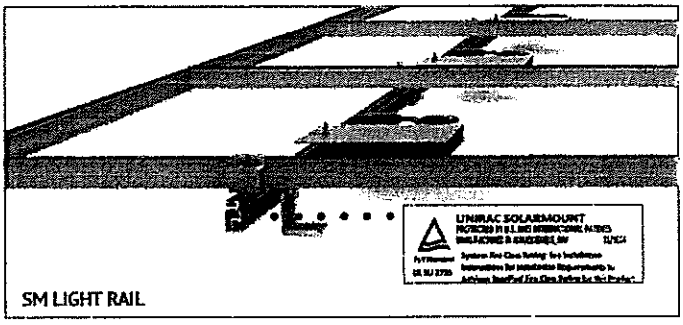
Rail Type	Module Type	System Level Fire Rating	Rail Direction	Module Orientation	Mitigation Required
Standard Rail	Type 1, Type 2, Type 3 & Type 10	Class A, Class B & Class C	East-West	Landscape OR Portrait	None Required
			North-South	Landscape OR Portrait	None Required
Light Rail	Type 1 & Type 2	Class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

UL2703 CERTIFICATION MARKING LABEL

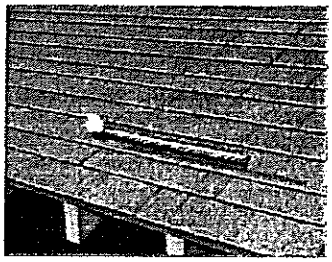
Unirac SOLARMOUNT is listed to UL 2703. Marking Labels are shipped with the Midclamps. After the racking system is fully assembled, a single Marking Label should be applied to the SOLARMOUNT rail at the edge of the array. Note: The sticker label should be placed such that it is visible, but not outward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



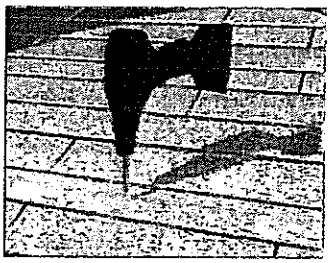
SM STANDARD RAIL



SM LIGHT RAIL



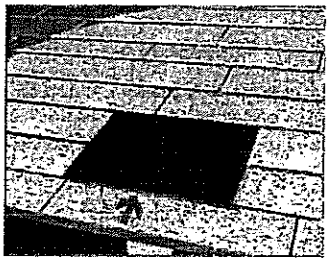
ROOF PREPARATION: Layout and install flashing at rafter locations determined per Design and Engineering Guide.



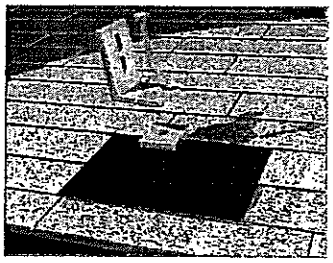
DRILL PILOT HOLES: Center the roof attachment over the rafter and drill a pilot hole(s) for the lag bolt(s).

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.

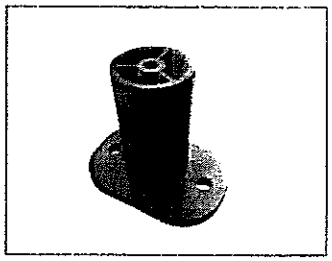


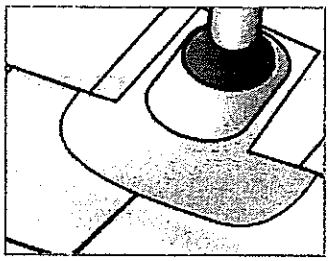
FLAT FLASHING INSTALLATION: Insert the Flat Flashing so the top part is under the next row of shingles and the hole lines up with the pilot hole.



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.

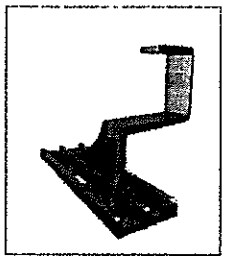


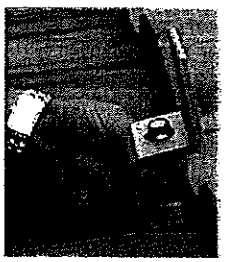


2 PIECE ALUMINUM STANDOFF WITH FLASHING & L-FOOT:

- 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.

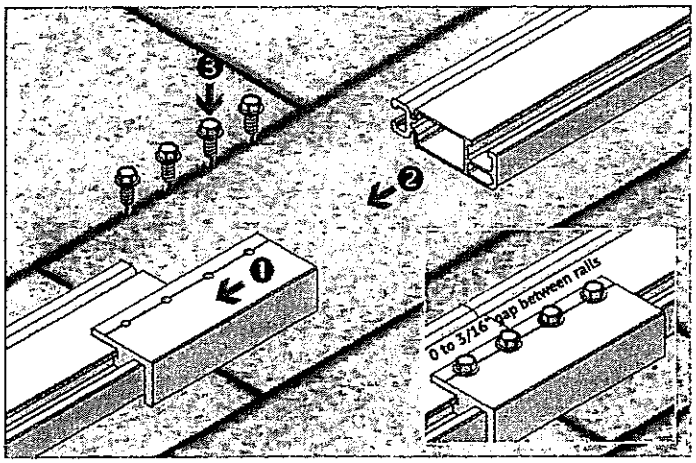




TOP MOUNT TILE HOOK & L-FOOT:

- 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.



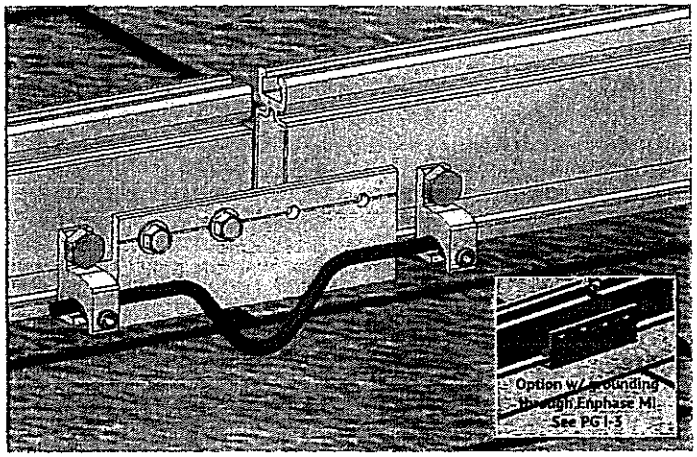
SPLICE INSTALLATION (IF REQUIRED PER SYSTEM DESIGN)

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.

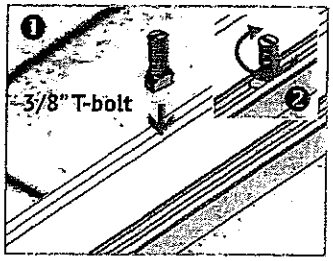
Max length of spliced rail is 40 ft. An expansion joint is required > 40 ft.



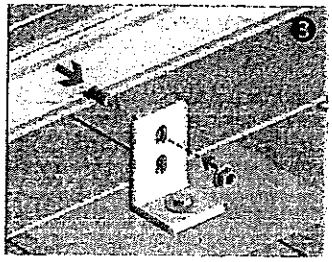
EXPANSION JOINT USED AS THERMAL BREAK

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.

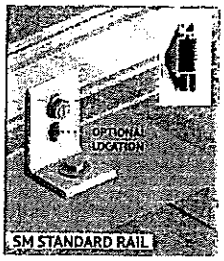


PLACE T-BOLT INTO RAIL & SECURE BOLT: Insert 3/8" T-bolt into rail at L-foot locations. Apply Anti-Seize to bolt. Rotate T-bolt into position.

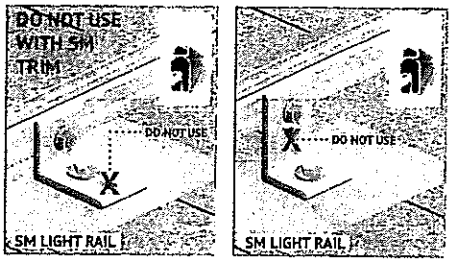


SECURE T-BOLT: Apply Anti-Seize to bolt. Rotate T-bolt into position.

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.



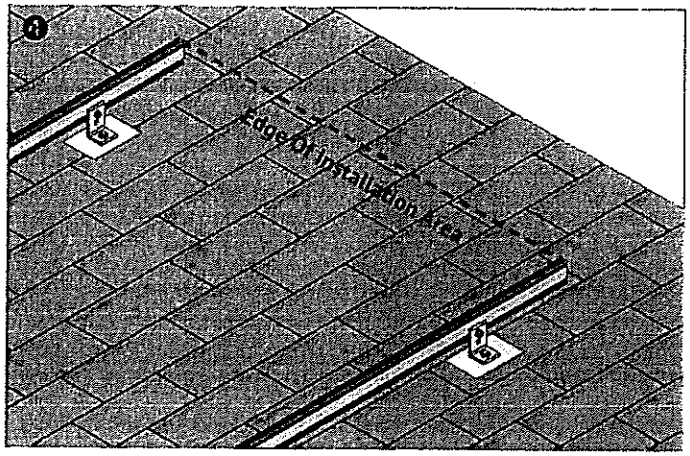
SM LIGHT RAIL: For a lower profile array when using SM Light rail, rotate the L-foot to orient the side with only one (1) slot against the rail. **Only use the slot location closet to the rail to connect the lag bolt to the flashing / roof on the side with two (2) slots.**

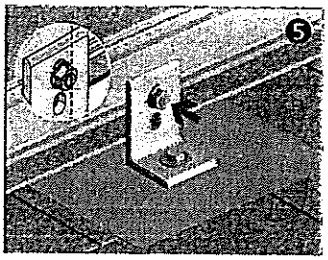
NOTE: Use only the top slot to connect the L-foot to the rail to obtain the desired height and alignment when using SM Light rail.

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.

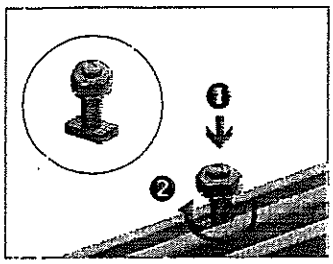
Mount modules to the rails as soon as possible. Large temperature changes may bow the rails within a few hours if module placement is delayed.



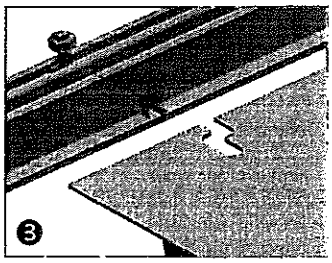


ALIGN POSITION INDICATOR: Hand tighten nut until rail alignment is complete. Verify that position indicator on bolt is vertical (perpendicular to rail)

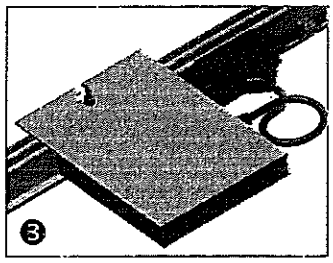
TORQUE VALUE (See Note on PG. A)
3/8" nut to 30 ft-lbs



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.

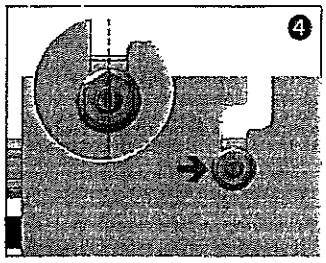


INSTALL MICROINVERTER: Install microinverter on to rail. Engage with bolt.



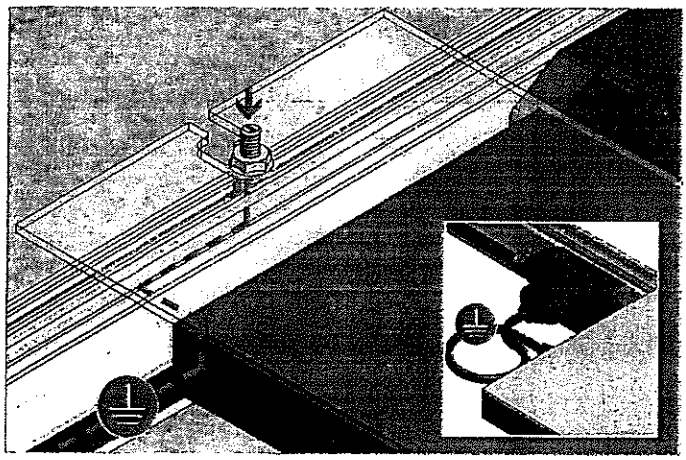
INSTALL MICROINVERTER:

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.

MICROINVERTER SYSTEM GROUNDING



SM EQUIPMENT GROUNDING THROUGH ENPHASE MICROINVERTERS

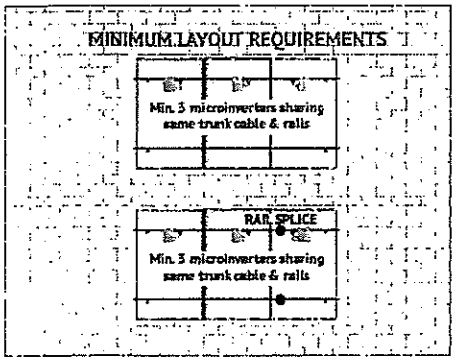
The Enphase M215 and M250 microinverters have integrated grounding capabilities built in. In this case, the DC circuit is isolated from the AC circuit, and the AC equipment grounding conductor (EGC) is built into the Enphase Engage integrated grounding (IG) cabling.

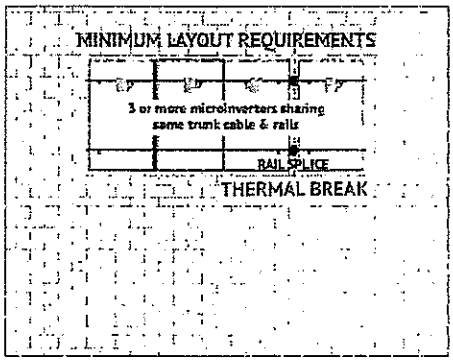
In order to ground the SOLARMOUNT racking system through the Enphase microinverter and Engage cable assembly, there must be a minimum of three PV modules connected to the same trunk cable within a continuous row. Continuous row is defined as a grouping of modules installed and bonded per the requirements 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.

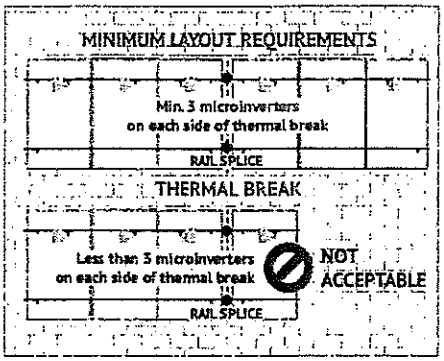
SOLARMOUNT INTEGRATED BONDING ADVANTAGE

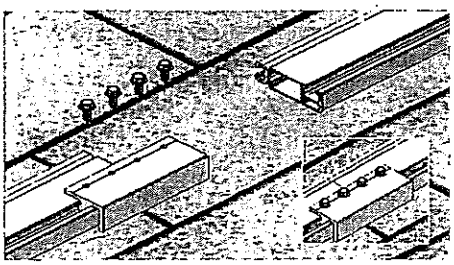
LOSE ALL THE COPPER & LUGS

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

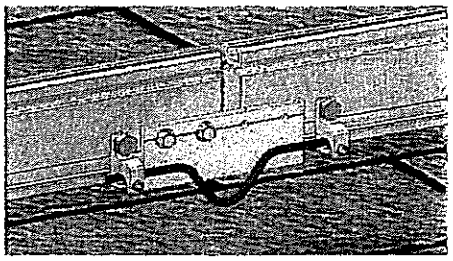




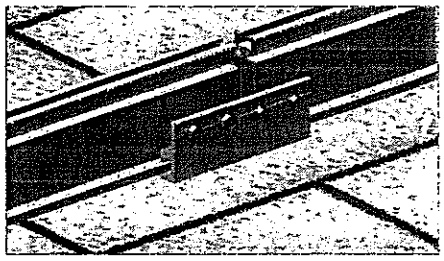




ELECTRICAL BONDING SPLICE



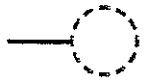
EXPANSION JOINT USED AS THERMAL BREAK W/ GROUNDING LUGS & COPPER JUMPER



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

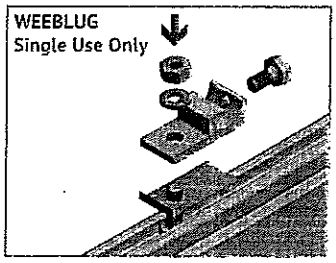
ONLY ONE LUG PER ROW OF MODULES:
Only one lug per row of modules is required.
See Page F for additional lugs required for expansion joints.

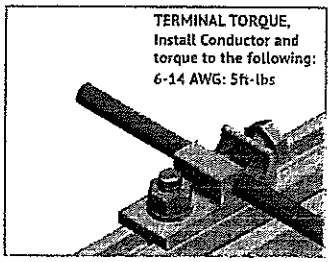


GROUNDING LUG MOUNTING DETAILS:
Details are provided for both the WEEB and Ilsco products. The WEEBLug has a grounding symbol located on the lug assembly. The Ilsco lug has a green colored set screw for grounding indication purposes. Installation must be in accordance with NFPA NEC 70, however the electrical 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

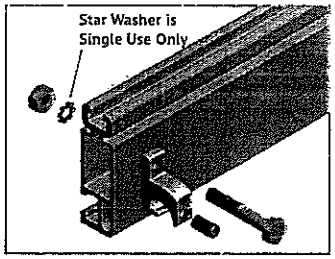
GROUNDING LUG - BOLT SIZE & DRILL SIZE		
GROUND LUG	**BOLT SIZE**	**DRILL SIZE**
WEEBLug	1/4"	N/A - Place in Top SM Rail Slot
ILSCO Lug	#10-32	7/32"

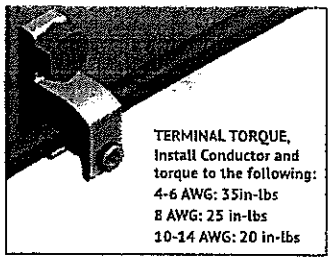
- Torque value depends on conductor size.
- See product data sheet for torque value.





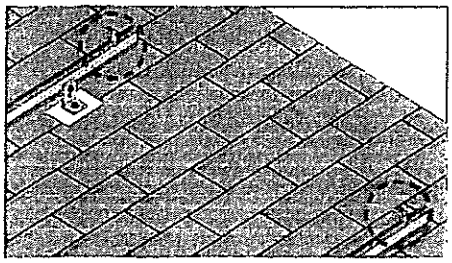
WEEBLUG CONDUCTOR - UNIRAC P/N 008002S:
Apply Anti Seize and insert a bolt in the aluminum rail and through the clearance hole in the stainless steel flat washer. Place the stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Place the lug portion on the bolt 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



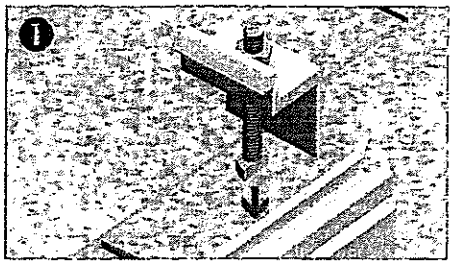


ILSCO LAY-IN LUG CONDUCTOR - UNIRAC P/N 008009P: Alternate Grounding Lug - Drill, deburr hole and bolt thru both rail walls per table.
TORQUE VALUE 5 ft lbs. (See Note on PG. A)
See ILSCO product data sheet for more details, Model No. GBL-4DBT.

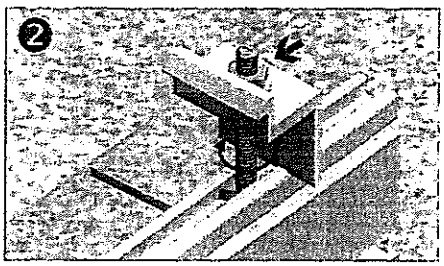
NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION



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.

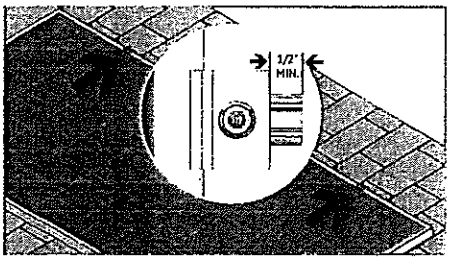


INSERT ENDCLAMP T-BOLT: Insert 1/4" T-bolt into rail.



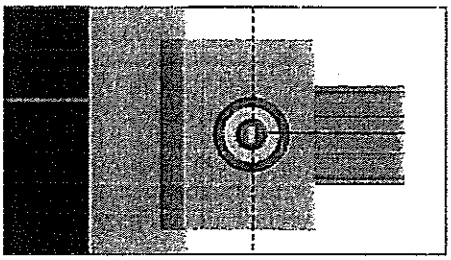
ROTATE ENDCLAMP T-BOLT: Rotate T-bolt into position. Verify that the position indicator & T-bolt shaft are angled in the correct position.

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



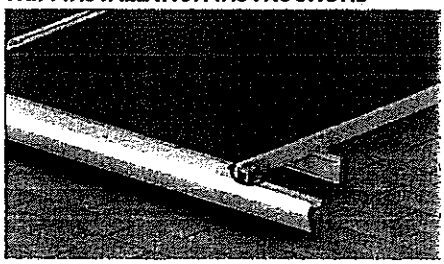
INSTALL FIRST MODULE: Install the first end module onto rails. Engage module frame with Endclamps. Verify that the position indicator & T-bolt shaft are angled in the correct position.

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



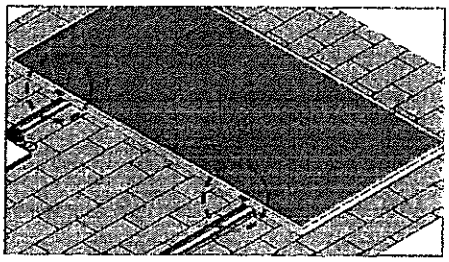
POSITION INDICATOR - SERRATED T-BOLT: Verify the T-bolt position indicator is perpendicular to the rail.

TRIM INSTALLATION INSTRUCTIONS

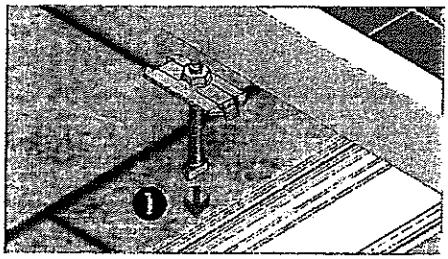


TRIM ENDCLAMPS: Install Endclamps on Trim in like manner to module endclamps per install instructions above.

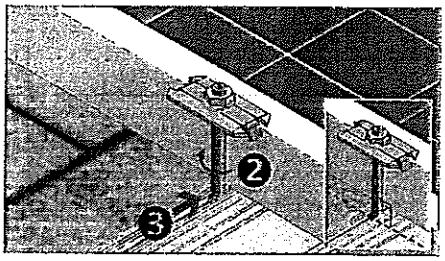
TORQUE VALUE (See Note on PG. 1)
1/4" nuts to 10 ft-lbs w/ Anti Seize



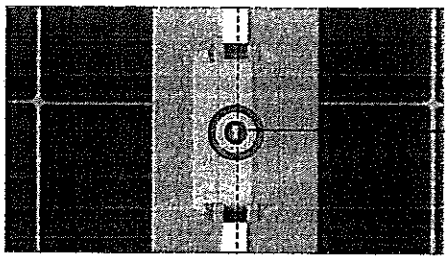
INSTALL MIDCLAMPS: Midclamp is supplied as an assembly with a T-bolt for module installation. Clamp assemblies may be positioned in rail near point of use prior to module placement.



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

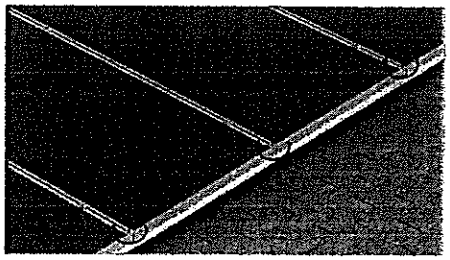


ROTATE MIDCLAMP T-BOLT: Rotate bolt into position and slide until bolt and clamp are against module frame. Do not tighten nut until next module is in position. Verify that the position indicator & T-bolt shaft are angled in the correct position.



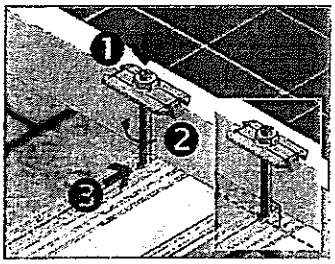
POSITION INDICATOR - SERRATED T-BOLT: Verify the T-bolt position indicator is perpendicular to the rail.

TRIM INSTALLATION INSTRUCTIONS



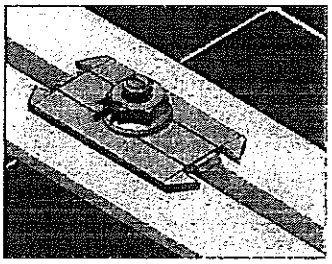
TRIM MIDCLAMPS: Ensure Trim lip is in contact with module face and verify alignment marks on T-bolts are in proper position, tighten midclamp on Trim, repeat at each gap between modules.

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



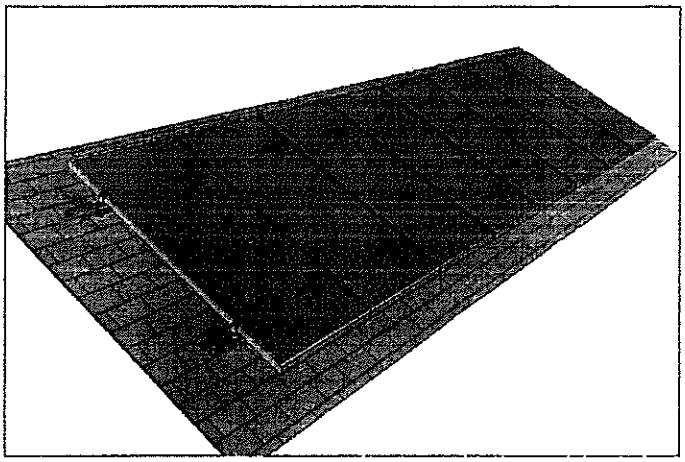
INSTALL REMAINING MID-CLAMPS: Proceed with module installation. Engage each module with previously positioned Midclamp assemblies.

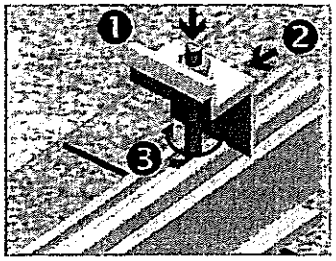
NOTE: Apply Anti-Seize to each Mid Clamp prior to installation.



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

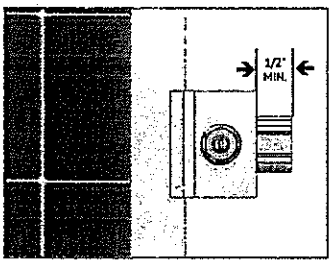
TORQUE VALUE (See Note on PG. A)
1/4" nuts to 10 ft-lbs. w/Anti Seize





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

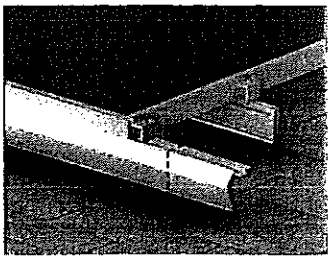


POSITION T-BOLT ALIGNMENT MARKS & CUT RAIL: Verify that the position indicator(s) & T-bolt shaft(s) are angled in the correct position. Trim off any excess rail, being careful not to cut into the roof. Allow ½" between the Endclamp and the end of the rail.

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

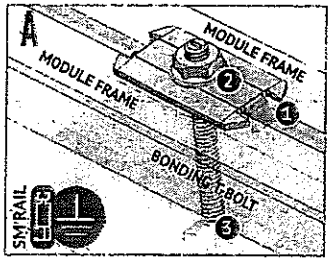
- Install second module
- Install remaining Midclamps & modules & position alignment marks
- Install Endclamps & position alignment marks
- Cut rail to desired length

TRIM INSTALLATION INSTRUCTIONS



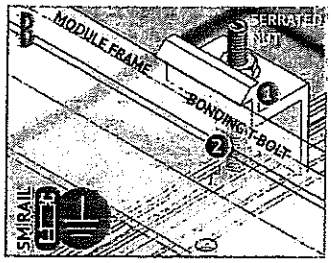
FINISH TRIM INSTALLATION, INSTALL ENDCLAMP & CUT EXCESS RAIL: Install final endclamp & Cut away excess Trim at end of array or where required for proper cantilevers. See D&E Guide or U-Builder for allowable cantilevers.

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



BONDING MIDCLAMP ASSEMBLY

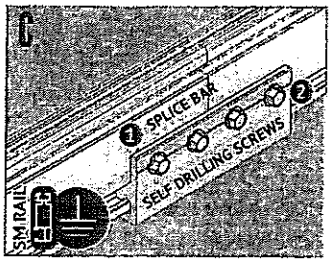
1. Stainless steel Midclamp points, 2 per module, pierce module frame anodization to bond module to module through clamp.
2. Serrated flange nut bonds stainless steel clamp to stainless steel T-bolt
3. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, clamp, and modules to grounded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

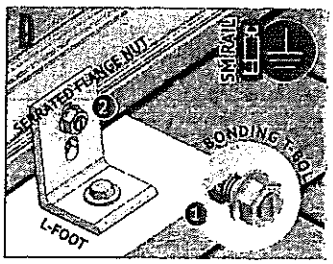
Note: End clamp does not bond to module frame.



BONDING RAIL SPLICE BAR

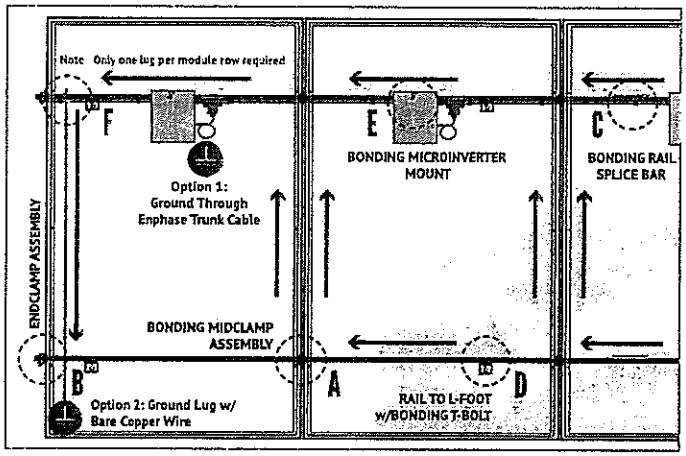
1. Stainless steel self drilling screws drill and tap into splice bar and rail creating bond between splice bar and each rail section
2. Aluminum splice bar spans across rail gap to create rail to rail bond. Rail on at least one side of splice will be grounded.

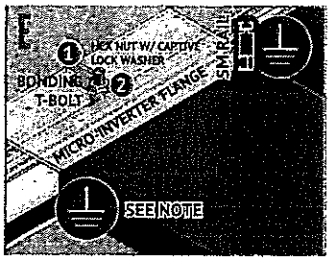
Note: Splice bar and bolted connection are non-structural. The splice bar function is rail alignment and bonding.



RAIL TO L-FOOT w/BONDING T-BOLT

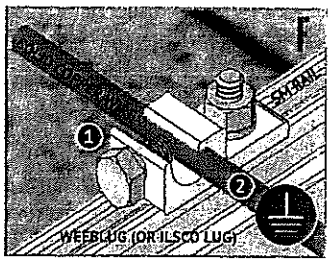
1. Serrated flange nut removes L-foot anodization to bond L-Foot to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail





BONDING MICROINVERTER MOUNT

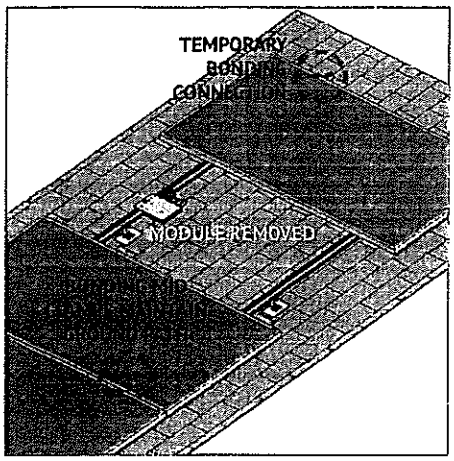
1. Hex nut with captive lock washer bonds metal microinverter flange to stainless steel T-bolt
2. Serrated T-bolt head penetrates rail anodization to bond T-bolt, nut, and L-foot to grounded SM rail System ground including racking and modules may be achieved through the trunk cable of approved microinverter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

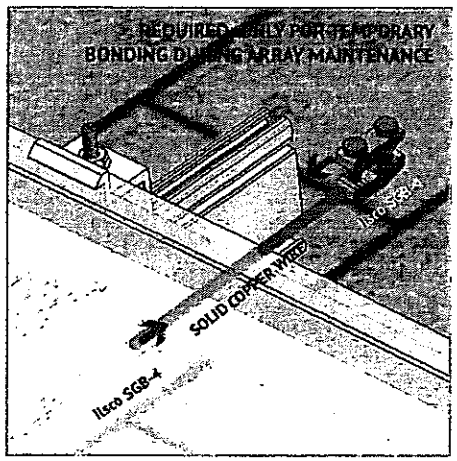


RACK SYSTEM GROUND

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

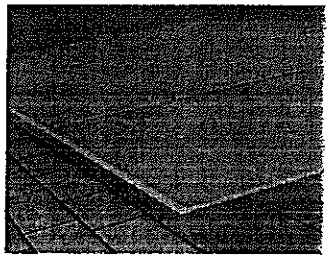
ELECTRICAL CONSIDERATIONS
SOLARMOUNT is intended to be used with PV modules that have a system voltage less than or equal to 1000 VDC. For standard system grounding a minimum 10AWG, 105°C copper grounding conductor should be used to ground a 1000 VDC system, according to the National Electric Code (NEC). 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.

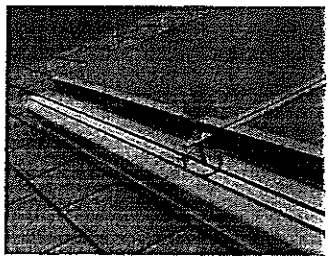
GROUNDING NOTES
The installation must be conducted in accordance with the National Electric Code (NEC) and the authority having jurisdiction. Please refer to these resources in your location for required grounding lug quantities specific to your project.

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.

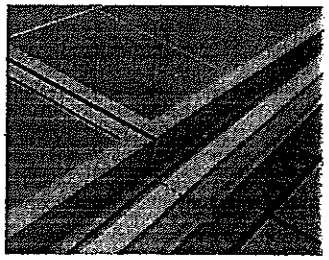


1ST MIDCLAMP: Position Trim in front of array. Insert Midclamp into the Trim slot, aligned with the gap between the 1st two modules at either end of array.

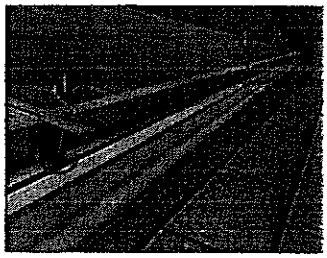
NOTE: Apply Anti-Seize to Each Mid-Clamp prior to installation

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.

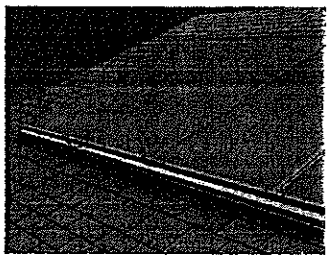
TORQUE VALUE: Do not exceed specified torque value (10 ft-lbs)



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.

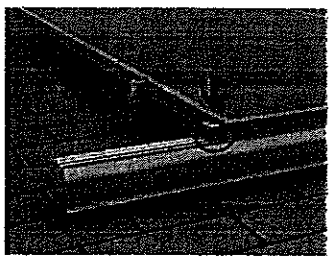


INSERT MIDCLAMPS: Insert T-bolt into slot and slide clamp (rotating Trim) into position between modules and leave loose. Continue to work down array, inserting Midclamps and positioning in gaps between modules.



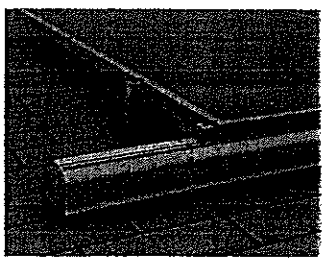
FASTEN MIDCLAMPS: Return to each inserted Midclamp. Ensuring Trim lip is in contact with module face and verifying alignment marks on T-bolts are in proper position, tighten clamp.

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

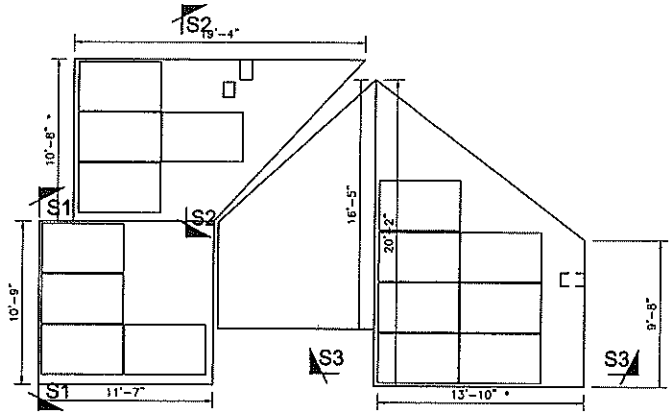


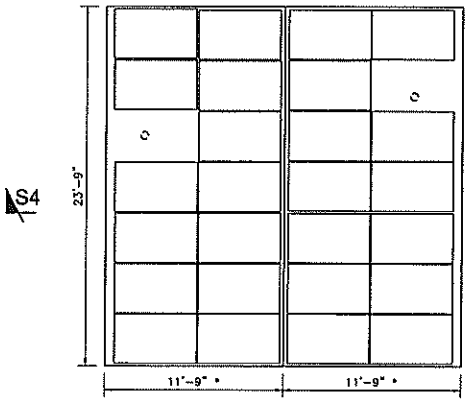
ENDCLAMPS: Install Endclamps per previous Endclamp install instructions

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.





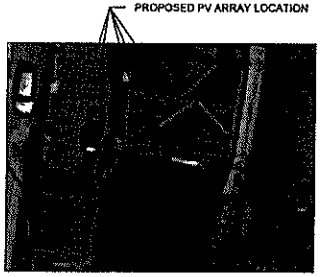
13

SOLAR PANEL LAYOUT

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

NOTES:

1. THE SYSTEM SHALL INCLUDE [41] TRINA SOLAR TSM-280DD05A.08(II) MODULES [DIMENSIONS: 65.0" (L) x 39.1"(W) x 1.38" (D)] AND WEIGHING 41.0 LBS (PANEL DEAD LOAD = 2.32PSF)]
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.



General Notes

SolarEnergyWorld

Tomorrow's Energy Today

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

DocuSigned by:

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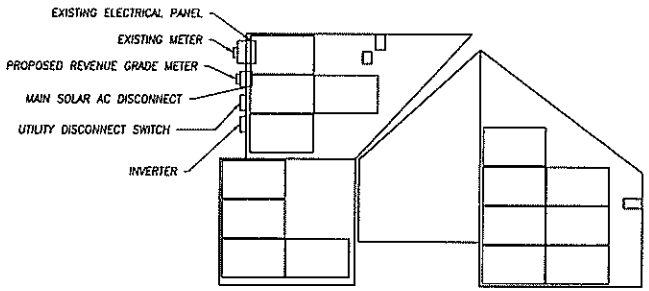
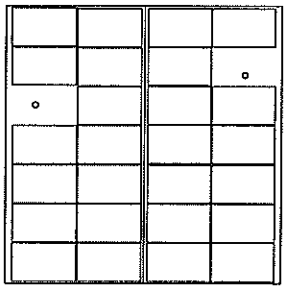
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 26331, EXPIRATION DATE:NOVEMBER 05, 2017.

Steven Kerr
310 Market St,
Brookeville, MD 20833
11.48kW

Drawn by	ESA
Date	22-FEB-2017
Scale	AS NOTED

Sheet: A001





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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Project Name and Address

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Drawn by	Sheet
ESA	E001
Date: 22-FEB-2017	
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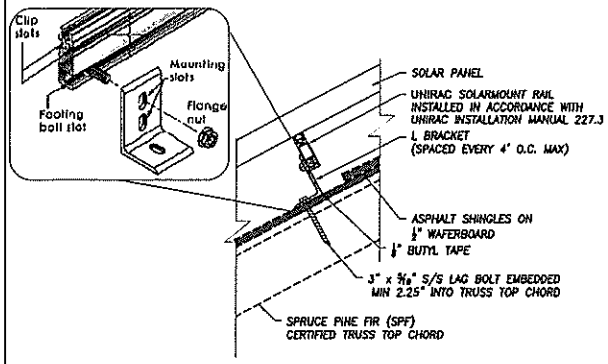
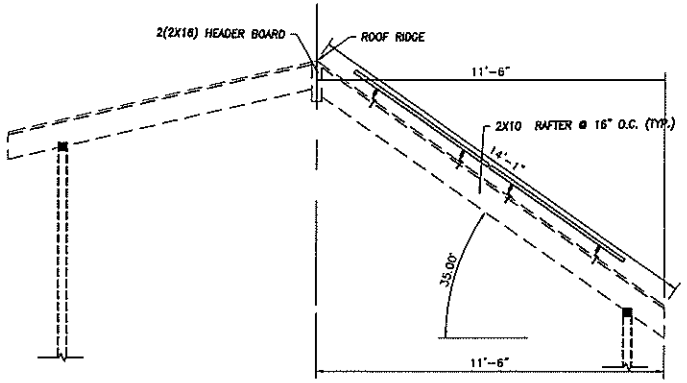
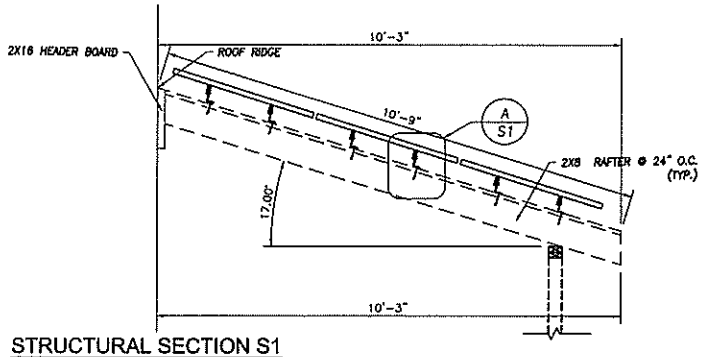


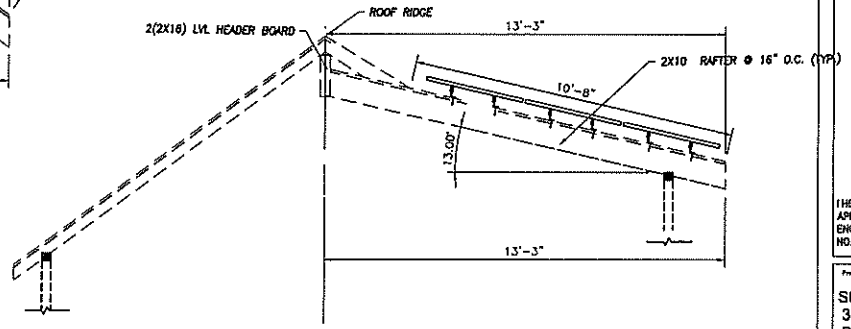
DETAIL A / S1
Scale: NTS



STRUCTURAL SECTION S3
Scale: 1/4" =1'-0"



STRUCTURAL SECTION S1
Scale: 3/8" =1'-0"



STRUCTURAL SECTION S2
Scale: 1/4" =1'-0"

35

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
   - 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.

General Notes

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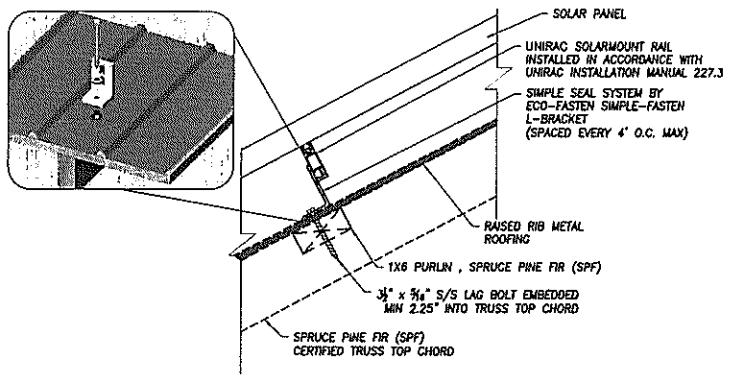
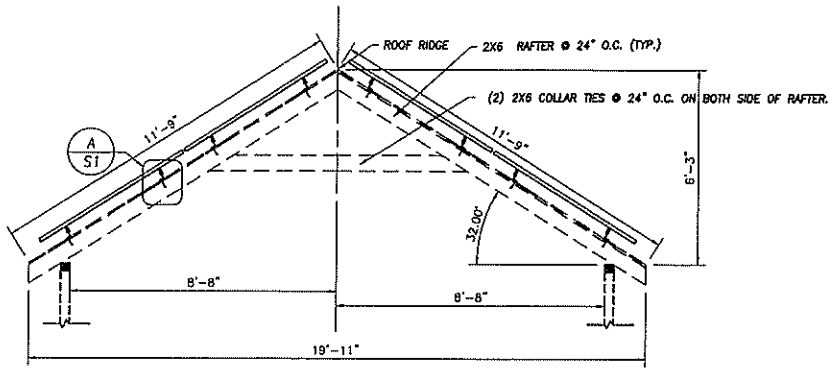
11.48kW

Drawn by: ESA
Date: 22-FEB-2017
Scale: AS NOTED

Sheet: S001



DETAIL A / S1
Scale: NTS



STRUCTURAL SECTION S4
Scale: 1/4" =1'-0"

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
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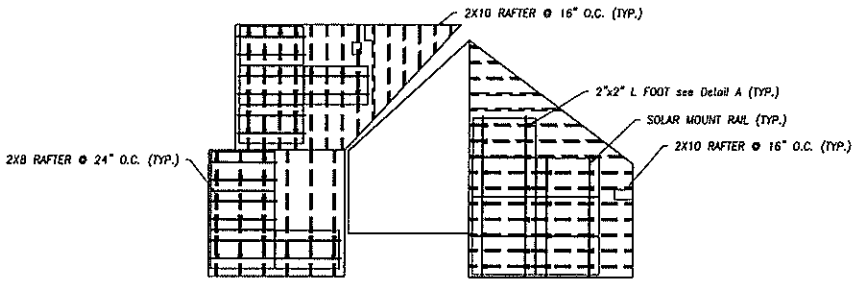
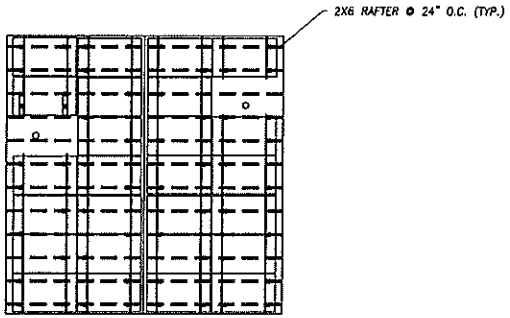
Drawn by: ESA	Sheet: S002
Date: 22-FEB-2017	
Scale: AS NOTED	





SOLAR PANEL FOOTING PLAN

Scale: 3/32" =1'-0"

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.

General Notes

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Project Name and Address

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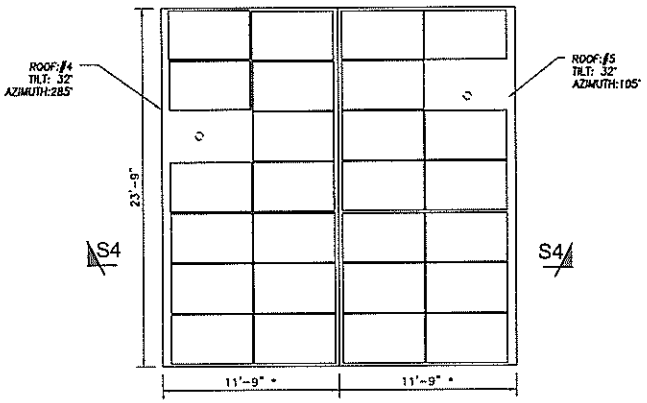
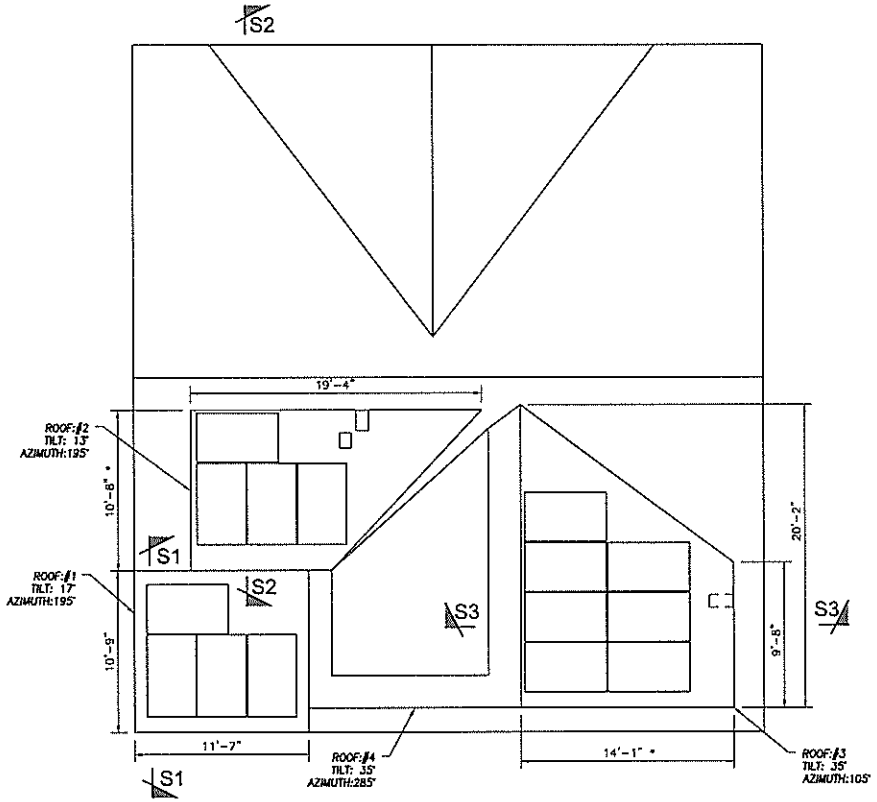
Drawn by: ESA	Sheet: S003
Date: 22-FEB-2017	
Scale: AS NOTED	





SOLAR PANEL LAYOUT

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

NOTES:

1. THE SYSTEM SHALL INCLUDE [41] TRINA SOLAR TSM-280DD05A.05(II) MODULES [DIMENSIONS: 65.0" (L) x 39.1"(W) x 1.38" (D)] AND WEIGHING 41.0 LBS (PANEL DEAD LOAD = 2.32PSF)]
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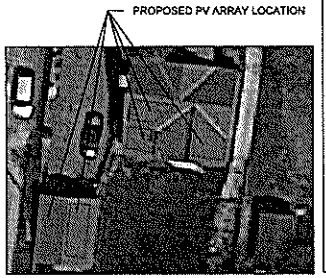

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Date: 22-FEB-2017	
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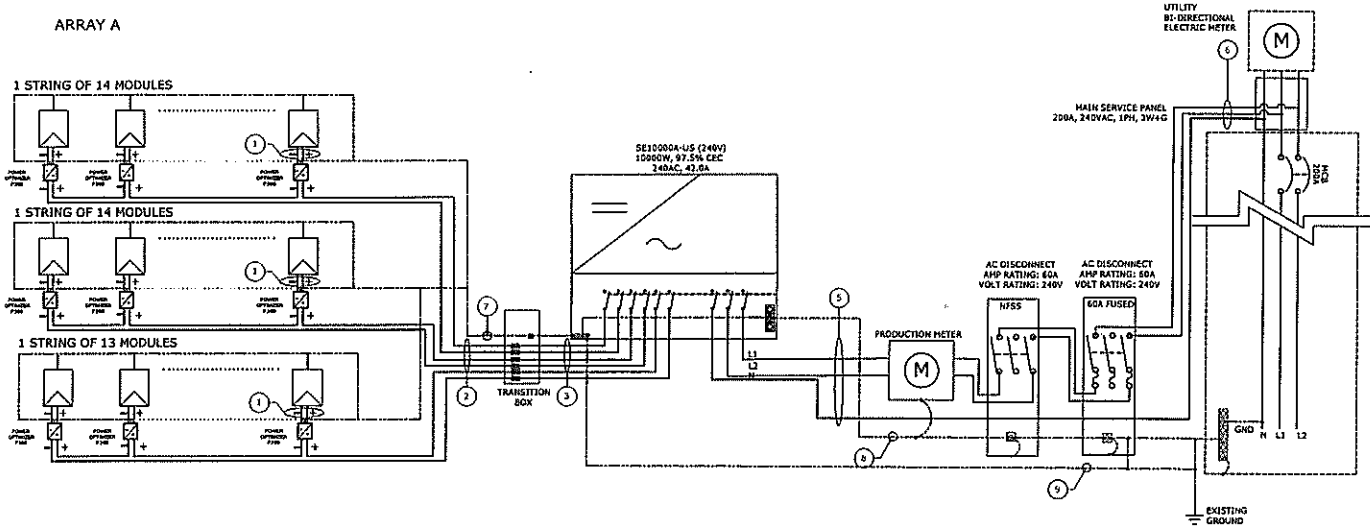

ARRAY A

Module Specs		
Model Number	TRINA TSM-280DD05.08	
Power	280 W	
Rated Voltage (Vmp)	31.7 V	
Rated Current (Imp)	8.84 A	
Open Circuit Voltage (Voc)	39.0 V	
Short Circuit Current (Isc)	9.35 A	
Maximum Sys Voltage	1000 V	
Optimizer Specifications		
OPTIMIZER MODEL	P300	
MAXIMUM DC VOLTAGE	48 V	
MAXIMUM POWER OUTPUT	300 W	
MAXIMUM DC CURRENT OUTPUT	15 A	
MAXIMUM DC CURRENT INPUT	12.5 A	
Inverter Specifications		
INVERTER MODEL	SE10000A-US(240v)	
MAXIMUM DC VOLTAGE	500 V	
MAXIMUM POWER OUTPUT	10000 W	
NOMINAL AC VOLTAGE	240 VAC	
MAXIMUM AC CURRENT	42 A	
ARRAY DETAILS		
NO. OF MODULES PER STRINGS	14	13
NO. OS STRINGS	2	1
ARRAY WATTS AT STC	7840	3640
MAX. VOLTAGE	500	500
690.53 Label Info.		
RATED VOLTAGE	350 V	350 V
RATED CURRENT/STRING	11.2 A	10.4 A
MAX. SYSTEM VOLTAGE	500 V	500 V
SHORT CIRCUIT CURRENT/STRING	15 A	15 A

3?

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	
4	DC Disconnect to Inverter	NA	Integrated
5	Inverter to AC Disconnect	#6 Cu THHN/THWN-2 IN EMT	
6	AC Disconnect to Utility Meter	#6 Cu THHN/THWN-2 IN EMT	
7	Equipment Grounding Conductor	#10 Bare Cu	
8	Equipment Grounding Conductor	#10 Cu THHN/THWN-2	
9	Grounding Electrode Conductor	#8 Cu	

1 THREE LINE DIAGRAM
SCALE: NA

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-GROUDNED (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 FUNDAMENTALS 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 AN Isc OF 6.4 AMPS WITH A 10 AMP FUSE.
    - 13.2. 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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ENGINEER'S STAMP

Steven Kerr
11.48 kW
310 Market St.
Brookeville, MD 20833

Three Line Electrical Drawing

REVISIONS			
REV	DWG #	DESCRIPTION	DATE
1	02	-	-

OPPORTUNITY	
PROJECT	
DATE DRAWN	3/9/17
DRAWN BY	MDM
DMS #:	REV. **

SHEET
E1