Building Permit Application

Howard County Maryland
Department of Inspections, Licenses and Permits
3430 Court House Drive
Permits: 410-313-2455
www.howardcountymd.gov

Date Received: _____

Permit No.: _____

Building Address: 16130 Patapsco Overlook Ct
City: Mount Airy State: MD Zip Code: 21771
Suite/Apt. #: _____ SDP/WP/BA #: _____
Census Tract: _____ Subdivision: _____
Section: _____ Area: _____ Lot: 6
Tax Map: 0002 Parcel: 0227 Grid: 0004
Zoning: _____ Map Coordinates: _____ Lot Size: 3.05Ac

Existing Use: SFD
Proposed Use: SFD With Solar
Estimated Construction Cost: $ 25,000.00
Description of Work: Install 39 ground mounted Solar Panels 11.70kW

Occupant or Tenant: _____
Was tenant space previously occupied? ☐Yes ☐No
Contact Name: _____
Address: _____
City: _____ State: _____ Zip Code: _____
Phone: _____ Fax: _____
Email: _____

Property Owner's Name: Harlan & Kathleen Stanbery
Address: 16130 Patapsco Overlook Ct
City: Mount Airy State: MD Zip Code: 21771
Phone: 443-621-0481 Fax: _____
Email: _____

Applicant's Name & Mailing Address. (If other than stated herein)
Applicant's Name: _____
Address: _____
City: _____ State: _____ Zip Code: _____
Phone: _____ Fax: _____
Email: _____

Contractor Company: Solar Energy World
Contact Person: John Stokes
Address: 5681 Main St
City: Elkridge State: MD Zip Code: 21075
License No. MHIC-127353
Phone: 410-479-2782 Fax: 410-524-1401
Email: JStokes@SolarEnergyWorld.com

Engineer/Architect Company: _____
Responsible Design Prof.: _____
Address: _____
City: _____ State: _____ Zip Code: _____
Phone: _____ Fax: _____
Email: _____

Commercial Building Characteristics	Residential Building Characteristics
Height:	☒ SF Dwelling ☐ SF Townhouse
No. of stories:	Depth / Width
Gross area, sq. ft./floor:	1st floor:
	2nd floor:
Area of construction (sq. ft.):	Basement:
	☐ Finished Basement
Use group:	☐ Unfinished Basement
	☐ Crawl Space
Construction type:	☐ Slab on Grade
☐ Reinforced Concrete	No. of Bedrooms:
☐ Structural Steel	Multi-family Dwelling
☐ Masonry	No. of efficiency units:
☐ Wood Frame	No. of 1 BR units:
☐ State Certified Modular	No. of 2 BR units:
	No. of 3 BR units:
	Other Structure:
	Dimensions:
Roadside Tree Project Permit	Footings:
☐Yes ☒No	Roof:
Roadside Tree Project Permit #	☐ State Certified Modular
	☐ Manufactured Home

Utilities	
Water Supply	
☐ Public	
☒ Private	
Sewage Disposal	
☐ Public	
☒ Private	
Electric: ☒ Yes ☐ No	
Gas: ☐ Yes ☐ No	
Heating System	
☒ Electric ☐ Oil	
☐ Natural Gas ☐ Propane Gas	
☐ Other:	
Sprinkler System:	
☐ Yes ☒ No	
Grading Permit Number:	
Building Shell Permit Number:	

THE UNDERSIGNED HEREBY CERTIFIES AND AGREES AS FOLLOWS: (1) THAT HE/SHE IS AUTHORIZED TO MAKE THIS APPLICATION; (2) THAT THE INFORMATION IS CORRECT; (3) THAT HE/SHE WILL COMPL WITH ALL REGULATIONS OF HOWARD COUNTY WHICH ARE APPLICABLE THERETO; (4) THAT HE/SHE WILL PERFORM NO WORK ON THE ABOVE REFERENCED PROPERTY NOT SPECIFICALLY DESCRIBED I THIS APPLICATION; (5) THAT HE/SHE GRANTS COUNTY OFFICIALS THE RIGHT TO ENTER ONTO THIS PROPERTY FOR THE PURPOSE OF INSPECTING THE WORK PERMITTED AND POSTING NOTICES.

Applicant's Signature _____ Print Name _____

JStokes@SolarEnergyWorld.com
Email Address

2/ /18
Date

Solar Energy World
Title/Company

Checks Payable to: DIRECTOR OF FINANCE OF HOWARD COUNTY
PLEASE WRITE NEATLY & LEGIBLY
-FOR OFFICE USE ONLY-

AGENCY	DATE	SIGNATURE OF APPROVAL
State Highways		
Building Officials		
PSZA (Zoning)		
PSZA (Engineering)		
Health	2/26/18	D Burnett

Is Sediment Control approval required for issuance? ☐ Yes ☐ No
☐ CONTINGENCY CONSTRUCTION START

DPZ SETBACK INFORMATION	
Front:	
Rear:	
Side:	
Side St.:	
All minimum setbacks met? ☐ Yes ☐ No	
Is Entrance Permit Required? ☐ Yes ☐ No	
Historic District? ☐ Yes ☐ No	
Lot Coverage for New Town Zone:	
SDP/Red-line approval date:	

Filing Fee	$
Permit Fee	$
Tech Fee	$
Excise Tax	$
PSFS	$
Guaranty Fund	$
Add'l per Fee	$
Total Fees	$
Sub- Total Paid	$
Balance Due	$
Check	#

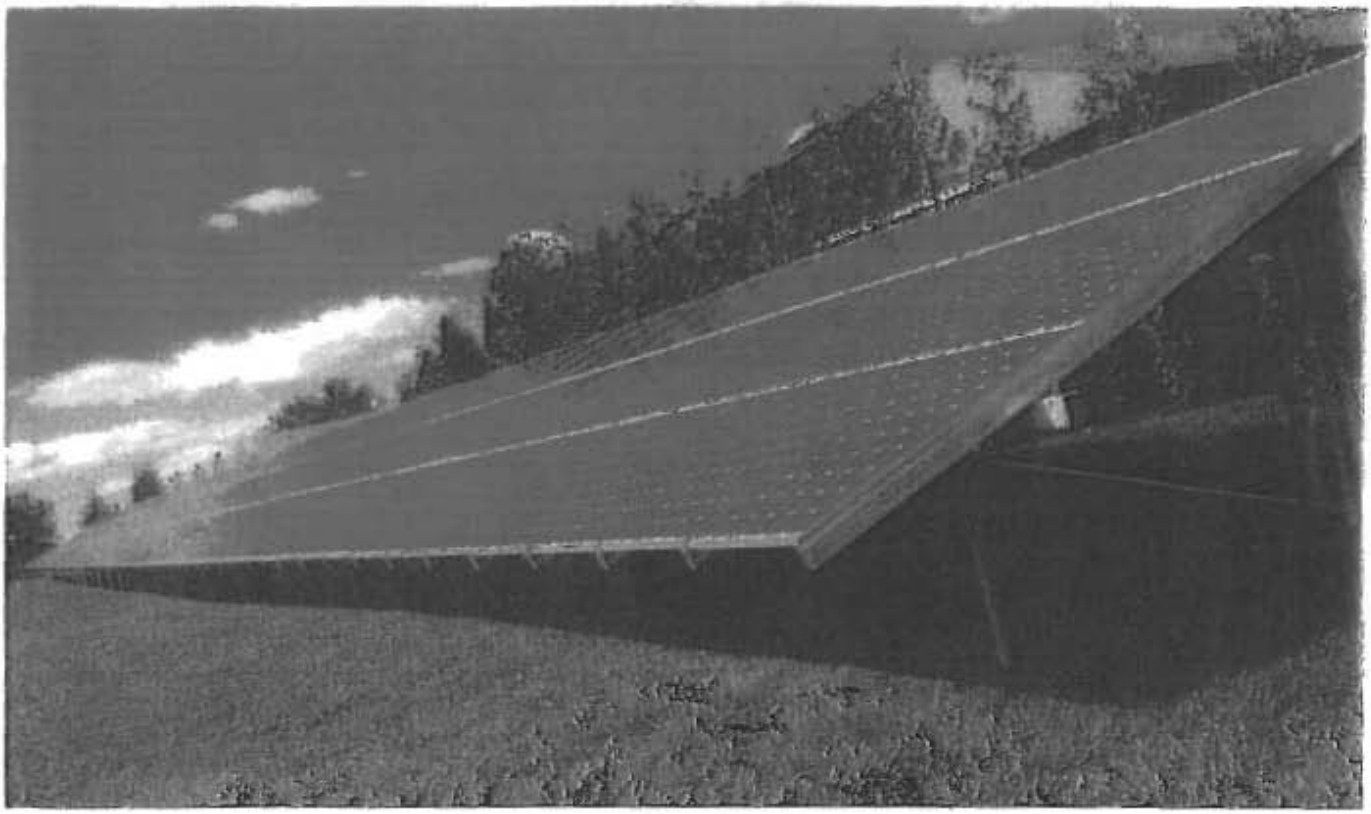
Distribution of Copies: White: Building Officials Green: PSZA,Zoning Yellow: PSZA,Engineering Pink: Health Gold: SHA

PV RACKING

The Racking System Designed by Installers for Installers

Rev.07
Dec, 2014

PV Racking Ground System Installation Instructions



Key benefits:

- Easy installation. No clamps! No messy lubricants! No more straining to lean over and fasten bolts!
- Installation time is far less than required by other systems.
- Module "Hold Down Area" is more than 10x that of conventional clamps.
- The strongest racking system on the market today. Rest assured, our rails will hold modules securely through the expansion/contraction changes due to seasonal temperature fluctuations.
- Module placement is seamless. No gaps between the modules results in a clean, sleek finish, without interruption.

This manual provides recommendations. Local and National codes govern the requirements for solar installation and must be followed.

PVRacking Ground System Installation Instructions

Table of Contents

Important: Please Read Before Starting

PV Racking components carry a 15 Year Limited Warranty. (See PV Racking 15 Year Limited Warranty for terms and conditions.) Installer shall install and operate all PV Racking components in accordance with the specifications and instructions from PV Racking and shall comply with all applicable rules, laws and regulations from local, state and federal governments and agencies, including the latest NEC Guidelines in connection with the installation of solar systems. FAILURE TO DO SO SHALL VOID ALL WARRANTIES FROM PV RACKING.

PLEASE REVIEW THIS MANUAL THOROUGHLY BEFORE INSTALLING YOUR PV RACKING SYSTEM.

Getting Started

This Installation Guide will provide you with the information needed for a professional installation. Please note the following items are the sole responsibility of the installer and must be completed prior to installation:

PV RACKING'S BILL OF MATERIALS ORDER SHEET IS USED SOLELY FOR CREATING A BILL OF MATERIALS FOR A SOLAR ARRAY AND DOES NOT INCLUDE ANY ENGINEERING ANALYSIS. PV RACKING STRONGLY RECOMMENDS THAT ALL SOLAR INSTALLERS USE THE SERVICES OF THEIR OWN PROFESSIONAL ENGINEERS IN DESIGNING A SOLAR ARRAY TO ENSURE IT SATISFIES ALL SITE SPECIFIC STRUCTURAL REQUIREMENTS.

Comply with all applicable local, state or national building codes, including the current NEC Guidelines, and any that may supersede this manual.

Verify that correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure and topographic factor should be confirmed with the local building official or a licensed professional engineer.

Verify that the roof structure is structurally sound and can support the array under all code level loading conditions that are appropriate. Verify that the ground structure supporting the array is structurally sound and can support the array under all code level loading conditions that are appropriate.

Only PV Racking parts used in conjunction with installer provided parts that are specified in the Installation Guide may be used. Substitution of other non approved parts may void the Limited Warranty.

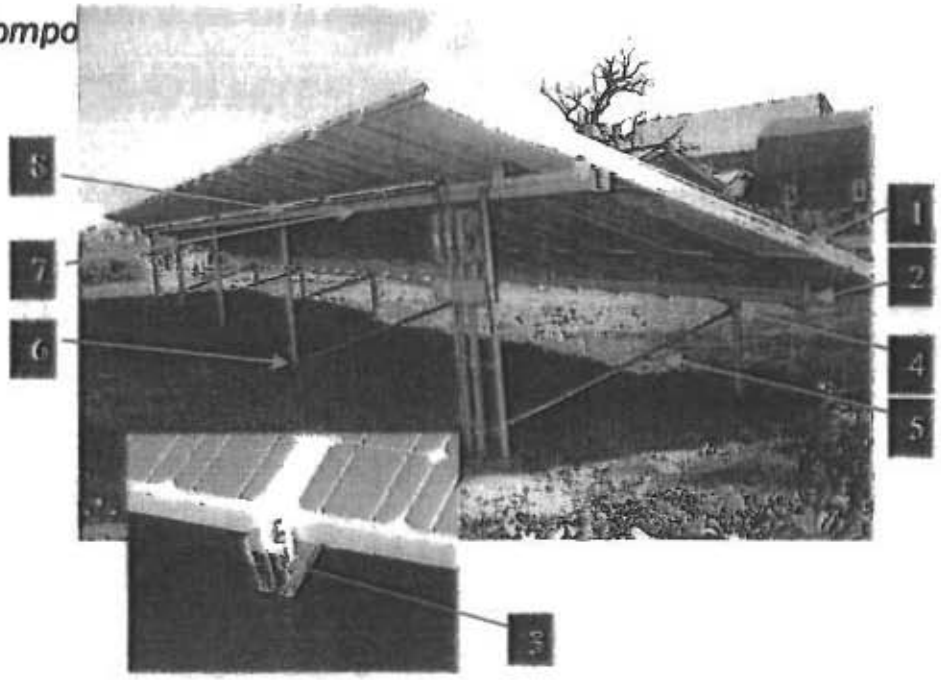
ALWAYS PROVIDE A WORK ENVIRONMENT THAT IS GEARED TOWARDS PERSONAL SAFETY!

1.0 The PV Racking Ground System

Conventions:

North:	toward the high side of the installation
South:	toward the low side of the installation
East:	toward the right side of the installation when facing north
West:	toward the left side of the installation when facing north
Horizontal:	east to west direction
Vertical:	north to south direction

1.1 Compo



1 **PV Racking Ground Rail, Gaaa-198** (where aaa depends on the thickness of the module frame [see below] and 198 is the length of the rail in inches)

Selecting Rails depends on the thickness of the module frame. There are five ranges available for modules. Please check the thickness of the module frame planned for the installation and select the proper Rail:

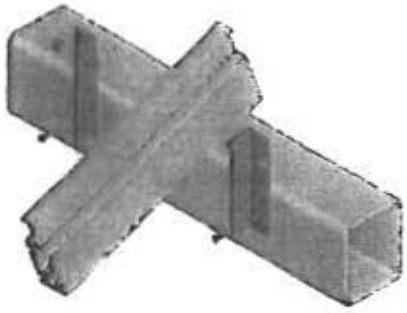
G135-198	Thickness of the module frame 1.16"-1.22" (29.5mm-31mm)
G153-198	Thickness of the module frame 1.34"-1.40" (34mm-35.56mm)
G178-198	Thickness of the module frame 1.57"-1.65" (39.8mm-41.91mm)
G194-198	Thickness of the module frame 1.77"-1.81" (44.95mm-45.97mm)
G213-198	Thickness of the module frame 1.97"-2.00" (50mm-50.80mm)

Rails sold in quantities of 6.

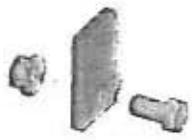
3 Ground Rail Mounting Brackets

Ground rail brackets connect the Rails to the horizontal beams. PVRacking Rails can be connected to three types of horizontal beams; (2" and 3" diameter schedule 40 pipes and 5"x 4" rectangular hollow beams). **PV Racking offers all components to install with a 5" x 4" rectangular hollow beam, as seen below.**

using self tapping screws (GBrcktL and GBrcktR)



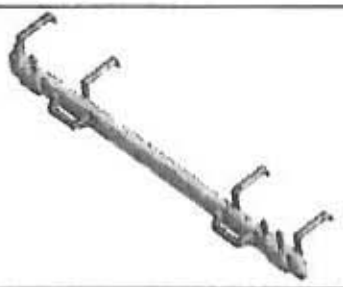
Each rail requires 4 brackets. Brackets sold in quantities of 20.

Self tapping Rail mounting brackets for 5" x 4" rectangular beam, left. GBrcktL	
Self tapping Rail mounting brackets for 5" x 4" rectangular beam, right. GBrcktR	
5 Module Stopper (each column of modules requires two stoppers) GStp	 

4 Post caps

Post caps connect the vertical "legs" of the supporting structure to the horizontal beams. There are three types of horizontal beams (2" and 3" diameter schedule 40 pipes and 5"x 4" rectangular beams) and three types of "legs" (2", 2.5" and 3" schedule 40 pipes).

Post cap assembly 2.5" diameter leg to 5"x4" horizontal beam FPC2.5-5x4	
5 **Cross Brace connects the top of the south "legs" to the bottom of the north "legs".** FCB	
6 **Cross Brace Connectors mounts to the bottom of the north "legs" and connects to the Cross Brace.**	
2.5" Cross Brace Connector mounts to the bottom of the 2.5" diameter north "legs" and connects to the Cross Brace. FCBC2.5	
7 **Horizontal Beam** HSS Galvanized, 24' long Sold in quantities of 1.	

Optional accessories	
5" x 4" Column Spacing Fixture makes installation quicker and more precise GSpacer-A2 Sold in quantities of 2.	

Wire Clip holds wires securely to the Rails. WireClip-A300 Sold in quantities of 300.	
WireRail provides protection for home run wires (17.5' long) GWW	

1.2 Overview of installation

PV Racking provides unique installation unmatched in its adjustability, simplicity and quality. Superior module retention is provided without any clamps, lubricants, and other tasks associated with clamping modules in place. PV Racking's strength and non-clamped retention is a perfect match for systems warranted for 25+ years.

Module installation is a quick three step process.

1. Install Ground Rail onto the frame.
2. Slide modules in place
3. Install stoppers

This manual reviews the steps that are required for successfully planning and installing a PV Racking Ground System. This manual will aid in deciding the number of rails required, installation techniques and grounding and wiring strategies.

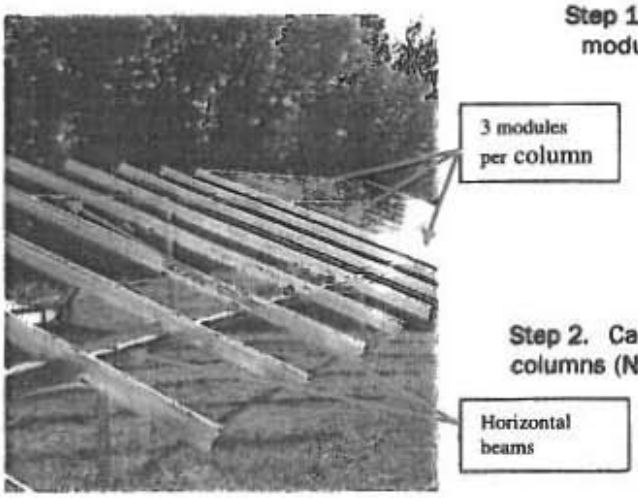
General notes:

- Plan the layout of the modules on the support structure. Portrait orientation is favored as this provides the most support for the modules along their long edges.
- Make sure that the support structure can take the load. A structural engineer should investigate and approve the structure. The structure should be long enough to provide support for the first and the last Rail pieces.
- Follow the installation steps described in this manual.

1.3 PV Racking Rail Installation

1.3.1 Calculate the number of rails required and installation dimensions

1.3.1.1 Calculate the number of rails required.



Step 1. Divide the total number of modules being installed by the number of modules in a column to get to the number of columns being installed (N_{oC}).

For example: 39 modules are installed in portrait format. There will be 3 modules per column. Calculate the number of columns as follows:

$N_{oC} = 39 / 3 = 13$ columns.

There will be 13 columns.

Step 2. Calculate the number of rails (N_{oR}) by adding 1 to the number of columns (N_{oC}).

Following the previous example:

$N_{oR} = N_{oC} + 1 = 13+1 = 14$ rails.

1.3.1.2 *Calculate the length of the Horizontal Beam.*

Calculate the length of the horizontal beam (L_{HB}) as follows:

$L_{HB} = N_{oc}$ * (horizontal width of module +0.225")+ 8"

For example: 39 modules are installed in portrait format. There will be 3 modules per column. N_{oc} =13. Module is Sharp NU-U235F1. Dimensions are 39.1" x 64.6". Modules are installed in portrait format.

Minimum length of the horizontal beam = (N_{oc} • (horizontal width of module + 0.225)) + 8
= (13 • (39.1+ 0.225))+8 =

= (13 • 39.325)+8 =

= 511.225+8 = 519.25"

Minimum length of the horizontal beam = 519.25" or about 43'-3"

1.3.1.3 Calculate the center distance between rails.

Calculate the center distance between rails (CD) as follows:

CD = horizontal dimension of the installed module + 0.225

For example: Module is Sharp NU-U235F1. Dimensions are 39.1" x 64.6". Modules are installed in portrait.

CD = horizontal dimension of the installed module + 0.225

CD = 39.1 + 0.225 = 39-21/64"

Using the GSpacer makes center dimension measurement obsolete. To use the templates set up the first two rails using tape measure and the above formula. Use these two rails to set up the templates. All additional rails can be quickly and precisely placed using the pair of templates without any further measuring.

1.3.1.4 Calculate the location of the Rail attachment points along the horizontal beam.

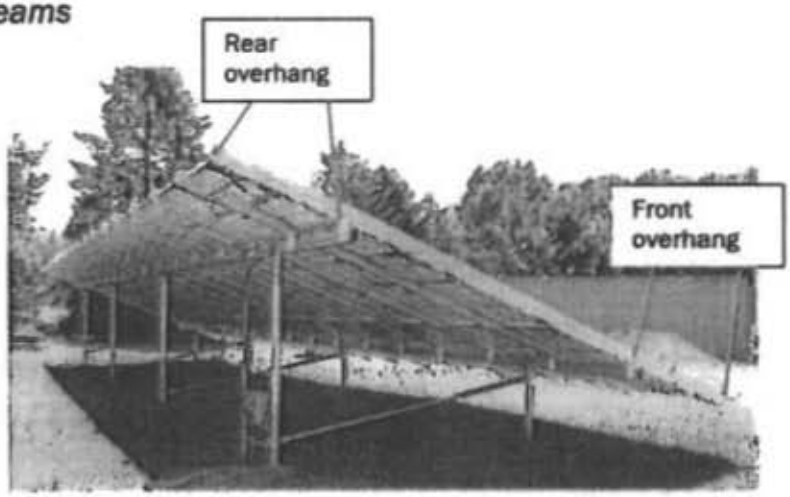
The exact position of the first Rail near the center of the horizontal beam depends on the number of columns (N_{oc}) calculated above. This is either an odd or an even number.
Case 1. Number of columns (N_{oc}) is even: There will be a Rail in the very center of the horizontal support beam.
Case 2. Number of columns (N_{oc}) is odd: The center of the first Rail piece is located on half of CD (calculated above) away from the center of the horizontal beam.

For example: N_{oc} =13. CD = 39-21/64"

Since N_{oc}=13 is an odd number, the center location for the first Rail is CD/2 (19-5/8") away from the center of the horizontal beam. Locate the very center of the horizontal beam and measure 19-5/8" away from this point to locate the center of the first Rail.

Once the first rail is mounted the other rails are located CD away (measured center-to-center) from this and other rails.

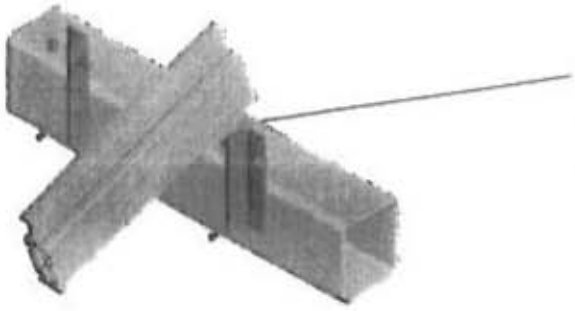
1.3.2 Mounting the Rails to the Horizontal Beams



Please note that the Rails must be installed such that the front and rear overhang dimensions are the same.

1.3.2.1 Mounting the Rail to the 5" x 4" structural Horizontal Beam.

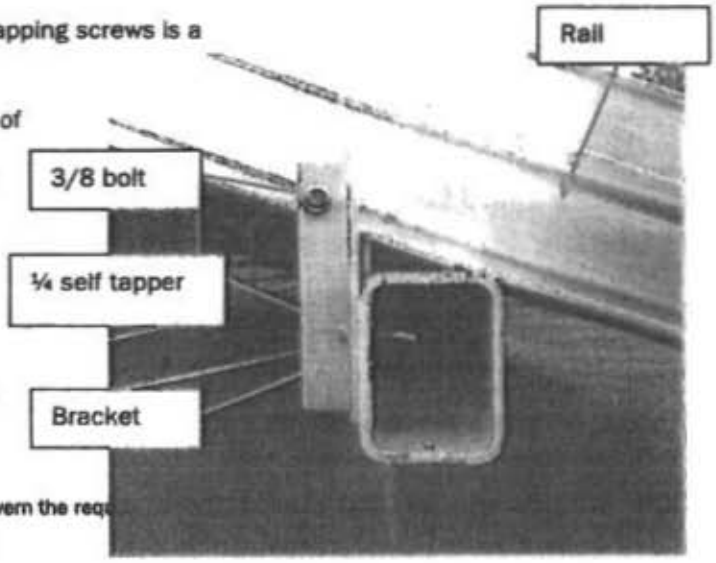
Connect to the 5"x 4" rectangular beams using self tapping screws (GBrcktL and GBrcktR)



Use WEEB washer to ground rail to bracket. One WEEB washer needed on single north bracket, one WEEB washer needed on single south bracket (for each rail). You should use two WEEB washers per rail.

Procedure for using the GBrcktL and GBrcktR brackets with self-tapping screws is a follows:

Step 1. Slide a 3/8 bolt head down the bottom T-slot on one side of the Rail. Make sure to use WEEB washer at connection point between rail and GBrckt. This will ground rails to HSS (along with self-tapping screw). **One WEEB washer needed to each HSS beam.**
Step 2. Install the bracket onto the bolt and hand-tighten the nut.
Step 3. Hold the bracket flat against the horizontal beam and mark the hole location for the self-tapper.
Step 4. Drill a pilot hole through the horizontal beam with a 7/32 drill at the mark.



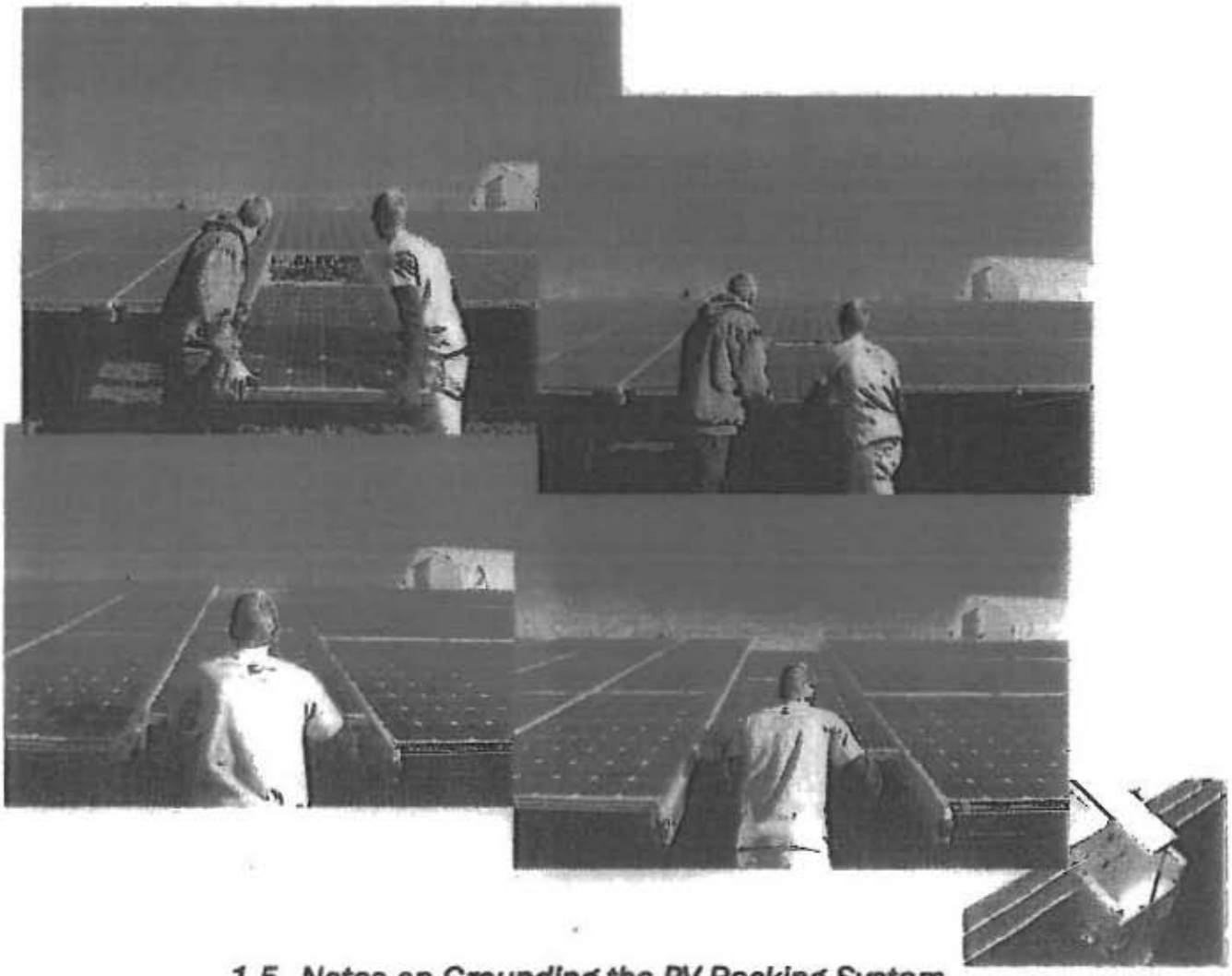
This manual provides recommendations. Local and National codes govern the req

Step 5. Install the self-tapper through the bracket and the hole in the cross beam. Tighten it to 5.5 ft-lbs. maximum.
Step 6. Tighten the 3/8 bolt to 15 ft-lbs. maximum.
Step 7. Repeat the above steps to install the second bracket on the other side of the Rail.
Step 8. Repeat the above steps to install the other GBrcktL and GBrcktR brackets at the other Horizontal Beam of the same rail.

Install the next Rail at the calculated Center Distance (CD) away from the first one. Slide a module into the Rails to check the spacing. Make two spacers to tightly fit between the installed Rails. (Cut up an extra Rail for this purpose. Alternatively, use the Column Spacing Fixtures if the horizontal beam is 5" x 4".) These spacers would speed up the installation.

1.4 Installing the modules and end stops

Install the modules by sliding them into the Rails. Fasten an end stop at the bottom of each Rail.



1.5 Notes on Grounding the PV Racking System

With DynoBond™:
The DynoBond™ replaces the conventional method of installing one ground lug per solar module and running a solid six gauge

copper wire bonding the modules. The DynoBond™ is a proprietary, UL recognized design that allows the DynoBond™ to be used as a jumper between modules and rails; making the module frames the medium for the equipment ground path.

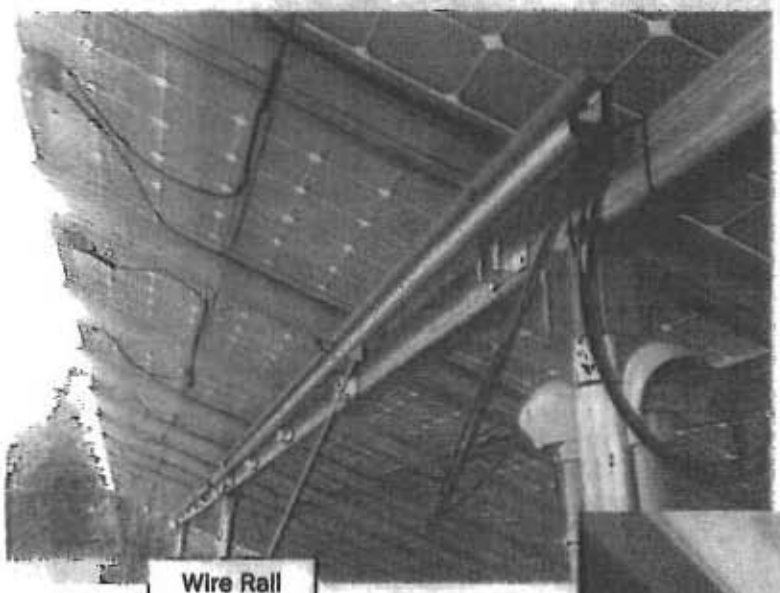
To ground module to module, slide stainless steel spring clip onto module frame. Connect adjacent panel frame with free end of the DynoBond™. To ground modules to rail, ground top module in column to the top of the PV Racking rail by bending tin-plated copper wire of DynoBond™ as needed. One stainless steel clip will connect to module frame, the other to the PV Racking rail. ** see PV Racking DynoBond™ Installation Instructions

HSS beams should be grounded with WEEB washer or lug.
Ground the sub-structure to a grounding electrode at the array per NEC regulations and local codes.

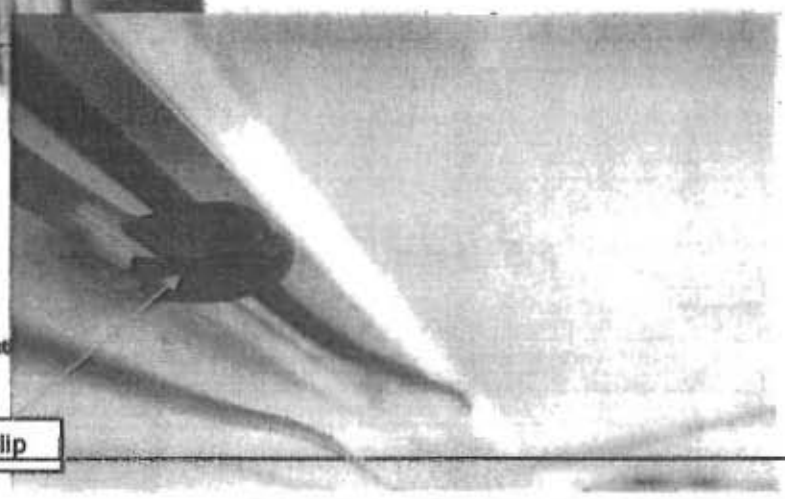
With Grounding Lugs:
Grounding rails with approved grounding lugs is necessary per NEC regulations and local code requirements. The rails provide T slots for WEEB grounding lugs from Wiley Electronics. Alternatively, the bottom surface of the rails is available for mounting approved grounding lugs using self tapping bolts. Ground the sub-structure to a grounding electrode at the array per NEC regulations and local codes. Grounding the modules should be done by installing approved grounding lugs on the modules and on the rails and connect these together. The installed equipment grounding is connected to the existing electrical systems according to the NEC code and local regulations.

Notes on Wire management with the PV Racking System

PV Racking offers advanced wire management that provides a reliable, long lasting solution to the challenges of routing home run wires. The rails include T-slots where the PVRacking Wire Clip can safely hold wires. Use as many Wire Clips as necessary. The Wire Rail supports long homerun wiring and provides protection against mechanical damage. Wires can enter and exit the Wire Rail at any point along its length.



Wire Rail



Wire Clip

This manual provides recommendations. Local and Nat

2.2 PV Racking 15 year Limited Warranty

PV Racking ("PV Racking") warrants to the original consumer purchaser ("Customer" or "Purchaser") that the PV Racking aluminum frame housing (the "Product") will be free from defects in materials or workmanship as described below under normal installation, application, use and service conditions, for a period of fifteen (15) years from the date of original purchase. If, within the specified warranty period, the Product shall be reasonably proven to be defective, then PV Racking will, at its option, either repair the defect or replace the defective Product or part thereof with a new or remanufactured equivalent at no charge to the Purchaser for parts or labor. PV Racking's total liability hereunder for such repair or replacement shall not exceed the original purchase price of the Product. This Limited Warranty does not cover failure to function caused by damage to the Product while in the Customer's possession, improper installation, unreasonable use or abuse of the Product, failure to provide or use of improper maintenance, failure to follow the written installation and use instructions, cosmetic damage, damage from accident, negligence, misuse, normal wear and tear, or acts of God, and is voided by failure to have the Product installed according to PV Racking's written Installation Manual, by an authorized installer or failure to operate or use the Product in accordance with instructions and warnings contained in the Installation Manual, or if the Product has been modified, repaired or reworked in a manner NOT PREVIOUSLY AUTHORIZED BY PV RACKING IN WRITING. This Limited Warranty does not apply to any foreign residue deposited on the finish. All installations in corrosive atmospheric conditions are excluded. This Limited Warranty does not cover damage to the Product that occurs during its shipment, storage or installation. Manufacturers of related items such as PV modules and flashings may provide written warranties of their own. PV Racking's Limited Warranty covers only its Product, and not any related items. PV Racking makes no warranty against defects in materials and workmanship by component parts from other manufacturers including but not limited to batteries, PV modules, inverters, transformers, disconnects, and data acquisition components. Warranties, if any, for these products may be available through Customer's authorized installer or contractor. This Limited Warranty is voided if the Product is modified, moved or relocated after the original installation.

Neither the sales personnel of PV Racking nor any other person is authorized to make any warranties other than those described herein, or to extend the duration of any warranties beyond the time period described above on behalf of PV Racking.

THE REMEDIES PROVIDED IN THE ABOVE LIMITED WARRANTY ARE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE TO THE CUSTOMER. NO OTHER EXPRESS WARRANTIES ARE MADE. ALL IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, ARE LIMITED IN DURATION AS SET FORTH ABOVE. IN NO EVENT SHALL PV RACKING BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, ECONOMIC OR PROPERTY DAMAGE OR PERSONAL INJURIES OR DEATH. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES OR DAMAGES FOR PERSONAL INJURY OR DEATH. Correction of defects, in the manner and for the period(s) of time described herein, shall constitute complete fulfillment of all liabilities and responsibilities of PV Racking to the Purchaser with respect to the Product and shall constitute full satisfaction of all claims, whether based on contract, negligence, strict liability or otherwise. Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This Limited Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

To obtain warranty services, the Purchaser must contact PV Racking by telephone or mail, and PV Racking will establish and initiate a review of the claim. The Purchaser must maintain proof of purchase of the Product to prove date of purchase in the unlikely event of a claim under this Limited Warranty.

Warranty service contacts:
PV Racking
505 Keystone Road
Southampton, PA 18966
Phone (610) 990-7199
Fax (267) 988-4219

2.0 General Notes

2.1 *Installation instruction updates*

PV Racking continuously improves the product line. The latest installation information is available at www.PVRacking.US. Contact PVRacking should you have any questions or require additional information (610) 990-7199).

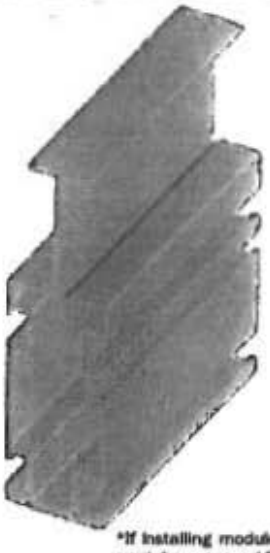
PV Racking provides continuous edge support for the modules. PV Racking does not put undo stress on the modules as it is designed to deflect minimally under full load. Design has been analyzed with advanced FEA methods and actual field testing. Please note that it is the installers' responsibility to check with the module manufacturer that this support method is acceptable.

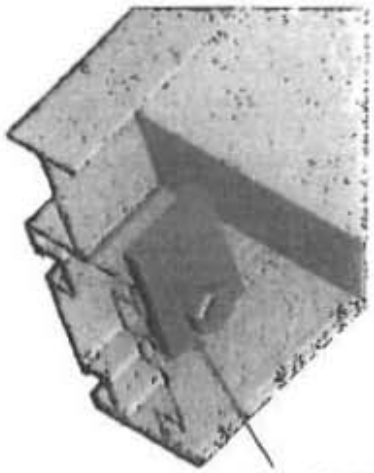
PV RACKING GROUND RAIL TECHNICAL DATASHEET

V001 August 2013

PV Racking Ground Mount Rail

G213 rail (1.97"-2.00")





*If installing modules in landscape, the module frame must be approved for mounting on the short side

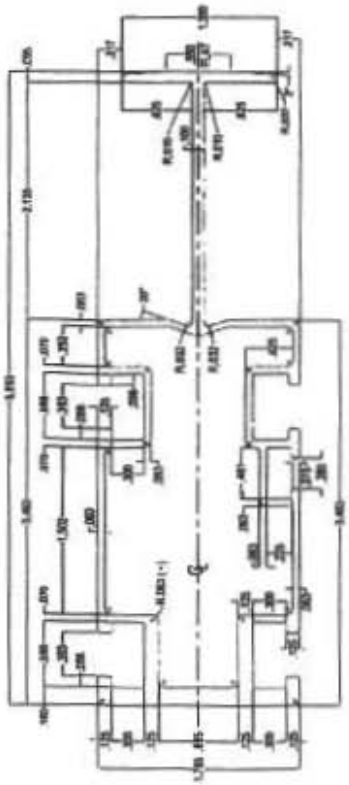
Rail

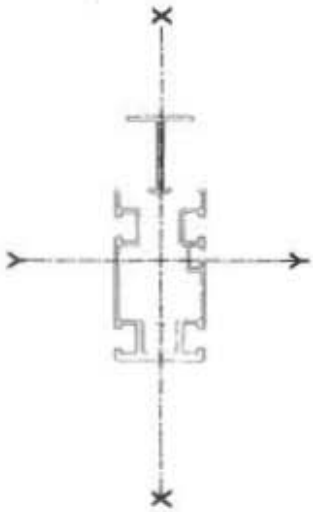
- Standard Finish: Mill finish
- Optional Finish: Clear or Black anodized

Module Stopper (GStp) Hardware

- 3/8-16 x 3/4 stainless steel hex head cap screw
- 3/8-16 serrated flange nut

Module Stopper
Each column of modules requires two stoppers





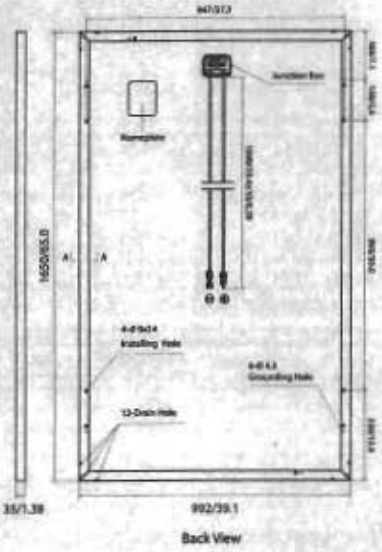
Rail Material	6105-T6
Rail Weight	1.844 lb/ft
Area	1.5325 SQ. IN
Perimeter	34.0547"
Radius of Gyration, r (X-X)	.5688"
Radius of Gyration, r (Y-Y)	1.8277"
Moment of Inertia, I (X-X)	.4959 IN^4
Moment of Inertia, I (Y-Y)	5.1195 IN^4
Section Modulus, S (X-X)	.5508 IN^3
Section Modulus, S (Y-Y)	1.4741 IN^3

ALLMAX plus

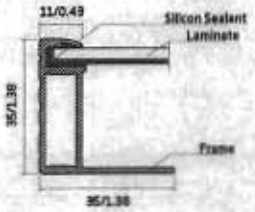
FRAMED 60-CELL MODULE

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

DIMENSIONS OF PV MODULE (mm/inches)

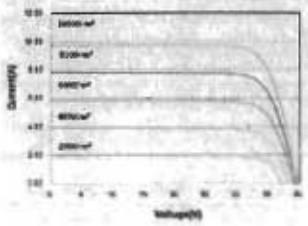


Back View

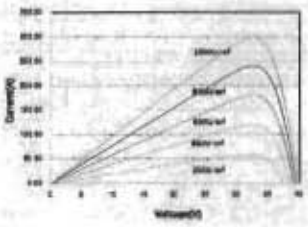


(A-A)

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_{MP} (V)	32.6
Maximum Power Current-I_{MP} (A)	9.19
Open Circuit Voltage-V_{OC} (V)	39.8
Short Circuit Current-I_{SC} (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_{MP} (V)	30.2
Maximum Power Current-I_{MP} (A)	7.38
Open Circuit Voltage-V_{OC} (V)	37.0
Short Circuit Current-I_{SC} (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 I_{SC}	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

Trinasolar

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

Version number: TSM_EN_2017_EXTENDED_A

www.trinasolar.com

THE

ALLMAX M 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

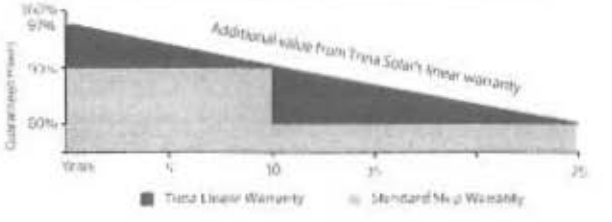
- Over 30 in-house tests (UV, TC, HF, and many more)
- In-house testing goes well beyond certification requirements
- PID resistant
- 100% EL double inspection
- Selective emitter, advanced surface texturing

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

10 Year Product Warranty · 25 Year Linear Power Warranty



Trinasolar

TECHNICAL DATA FRONIUS PRIMO

INPUT DATA	PRIMO 3.8-1	PRIMO 5.0-1	PRIMO 6.0-1	PRIMO 7.6-1	PRIMO 8.2-1
Recommended PV power (kWp)	3.0 - 6.0 kW	4.0 - 7.8 kW	4.8 - 9.3 kW	6.1 - 11.7 kW	6.6 - 12.7 kW
Max. usable input current (MPPT 1/MPPT 2)	18 A / 18 A	18 A / 18 A	18 A / 18 A	18 A / 18 A	18 A / 18 A
Total max. DC current	36 A				
Max. array short circuit current (1.25 Imax) (MPPT 1/ MPPT 2)	22.5 A / 22.5 A				
Operating voltage range	80 V - 600 V				
Max. input voltage	600 V				
Nominal input voltage	410 V	420 V	420 V	420 V	420 V
Admissable conductor size DC	AWG 14 - AWG 6				
MPP Voltage Range	200 - 480 V	240 - 480 V	240 - 480 V	250 - 480 V	270 - 480 V
Number of MPPT	2				

OUTPUT DATA		PRIMO 3.8-1	PRIMO 5.0-1	PRIMO 6.0-1	PRIMO 7.6-1	PRIMO 8.2-1
Max. output power	240 V	3800 W	5000 W	6000 W	7600 W	8200 W
	208 V	3800 W	5000 W	6000 W	7600 W	7900 W
Max. continuous output current	240 V	15.8 A	20.8 A	25.0 A	31.7 A	34.2 A
	208 V	18.3 A	24.0 A	28.8 A	36.5 A	38.0 A
Recommended OCPD/AC breaker size	240 V	20 A	30 A	35 A	40 A	45 A
	208 V	25 A	30 A	40 A	50 A	50 A
Max. Efficiency		96.7 %	96.9 %	96.9 %	96.9 %	97.0 %
CEC Efficiency	240 V	95.0 %	95.5 %	96.0 %	96.0 %	96.5 %
Admissable conductor size AC		AWG 14 - AWG 6				
Grid connection		208 / 240 V				
Frequency		60 Hz				
Total harmonic distortion		< 5.0 %				
Power factor (cos $\varphi_{ac,r}$)		0.85 1 ind./cap				

INPUT DATA	PRIMO 10.0-1	PRIMO 11.4-1	PRIMO 12.5-1	PRIMO 15.0-1
Recommended PV power (kWp)	8.0 - 12.0 kW	9.1 - 13.7 kW	10.0 - 15.0 kW	12.0 - 18.0 kW
Max. usable input current (MPPT 1/MPPT 2)	33.0 A / 18.0 A			
Total max. DC current	51 A			
Max. array short circuit current (1.25 Imax) (MPPT 1/MPPT 2)	41.3 A / 22.5 A			
Operating voltage range	80 V - 600 V			
Max. input voltage	600 V			
Nominal input voltage	415 V	420 V	425 V	440 V
Admissable conductor size DC	AWG 14 - AWG 6 copper direct, AWG 6 aluminium direct (AWG 10 copper or AWG 8 aluminium for overcurrent protective devices up to 60A, from 61 to 100A minimum AWG 8 for copper or AWG 6 aluminium has to be used), AWG 4 - AWG 2 copper or alu minium with optional input combiner			
MPP Voltage Range	220 - 480 V	240 - 480 V	260 - 480 V	320 - 480 V
Integrated DC string fuse holders	4 and 4+ for MPPT 1 / no fusing required on MPPT 2			
Number of MPPT	2			

OUTPUT DATA		PRIMO 10.0-1	PRIMO 11.4-1	PRIMO 12.5-1	PRIMO 15.0-1
Max. output power	240 V	9995 W	11400 W	12500 W	15000 W
	208 V	9995 W	11400 W	12500 W	13750 W
Max. continuous output current	240 V	41.6 A	47.5 A	52.1 A	62.5 A
	208 V	48.1 A	54.8 A	60.1 A	66.1 A
Recommended OCPD/AC breaker size	240 V	60 A	60 A	70 A	80 A
	208 V	70 A	70 A	80 A	90 A
Max. Efficiency		96.7 %			
CEC Efficiency		96.0 %			96.5 %
Admissable conductor size AC		AWG 10 - AWG 2 copper (solid / stranded / fine stranded)(AWG 10 copper or AWG 8 aluminium for overcurrent protective devices up to 60A, from 61 to 100A minimum AWG 8 for copper or AWG 6 aluminium has to be used) , AWG 6 - AWG 2 copper(solid / stranded) MultiContact Wiringable with AWG 12			
Grid connection		208 / 240 V			
Frequency		60 Hz			
Total harmonic distortion		< 2.5 %			
Power factor (cos $\varphi_{ac,r}$)		0.1 ind./cap			

Fronius USA LLC
6797 Fronius Drive
Portage, IN 46368
USA
pv-support usa@fronius.com
www.fronius-usa.com

Rev. 11.3.15 USA

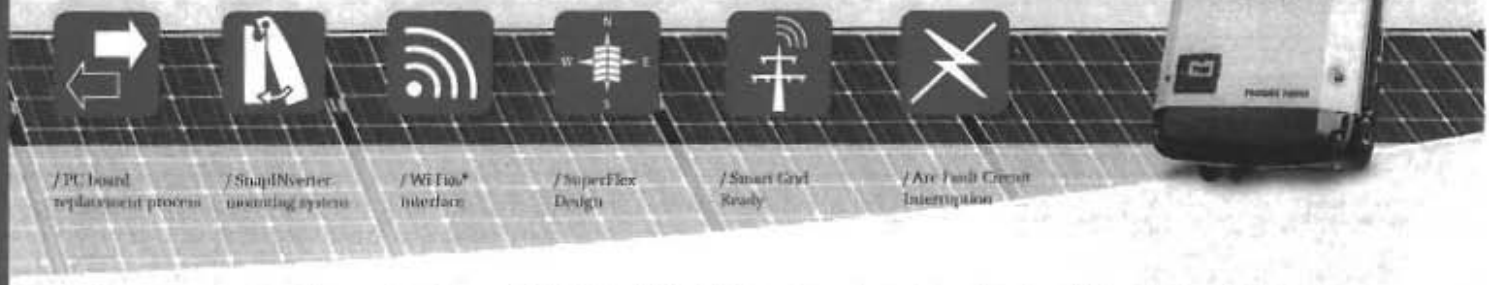
/ Perfect Welding / Solar Energy / Perfect Charging

Fronius

SHIFTING THE LIMITS

FRONIUS PRIMO

/ The future of residential solar is here - Introducing the new Fronius Primo.



/ PC board replacement process | / SnapINverter mounting system | / Wi Fio* interface | / SuperFlex Design | / Smart Grid Ready | / Arc Fault Circuit Interruption

/ With power categories ranging from 3.8 kW to 15.0 kW, the transformerless Fronius Primo is the ideal compact single-phase inverter for residential applications. The sleek design is equipped with the SnapINverter hinge mounting system which allows for lightweight, secure and convenient installation and service. The Fronius Primo has several integrated features that set it apart from competitors including dual powerpoint trackers, high system voltage, a wide input voltage range, Wi-Fi* and SunSpec Modbus interface for seamless monitoring and datalogging, Arc Fault Circuit Interruption (AFCI), and Fronius' online and mobile platform Fronius Solar.web. The Fronius Primo is designed to adjust to future standards, offering a complete solution to code restrictions and technical innovations of tomorrow. It also works seamlessly with the Fronius Rapid Shutdown Box for a reliable NEC 2014 solution.

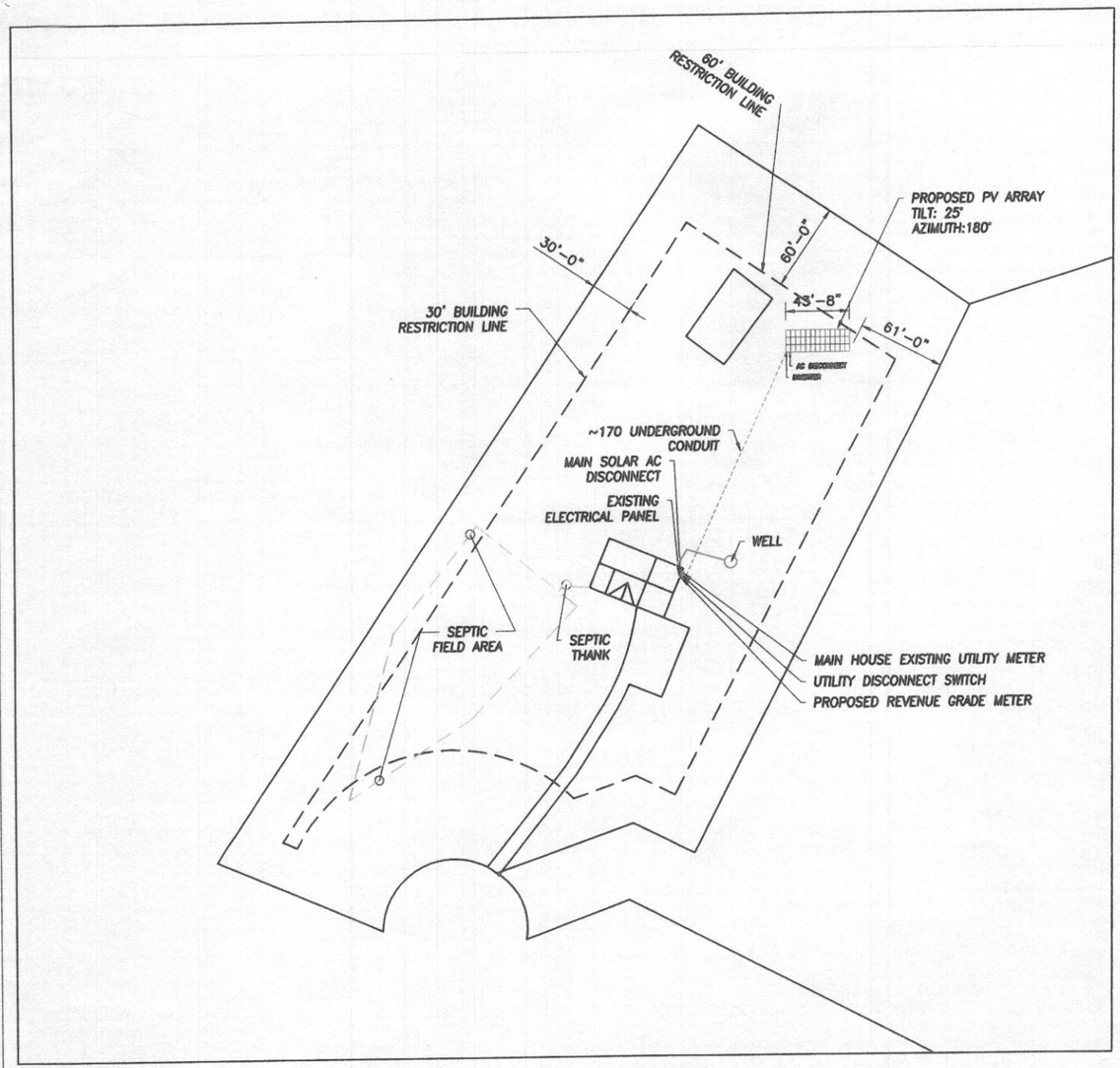
TECHNICAL DATA FRONIUS PRIMO

GENERAL DATA	FRONIUS PRIMO 3.8 - 8.2	FRONIUS PRIMO 10.0-15.0
Dimensions (width x height x depth)	16.9 x 24.7 x 8.1 in.	20.1 x 28.5 x 8.9 in.
Weight	47.2 lbs.	82.5 lbs.
Degree of protection	NEMA 4X	
Night time consumption	< 1 W	
Inverter topology	Transformerless	
Cooling	Variable speed fan	
Installation	Indoor and outdoor installation	
Ambient operating temperature range	-40 - 131°F (-40 - 55°C)	-40 - 140°F (-40 - 60°C)
Permitted humidity	0 - 100 %	
DC connection terminals	4x DC+ and 4x DC- screw terminals for copper (solid / stranded / fine stranded) or aluminum (solid / stranded)	4x DC+1, 2x DC+2 and 4x DC- screw terminals for copper (solid / stranded / fine stranded) or aluminum (solid / stranded)
AC connection terminals	Screw terminals 12 - 6 AWG	
Revenue Grade Metering	Optional (ANSI C12.1 accuracy)	
Certificates and compliance with standards	UL 1741-2010, UL1998 (for functions: AFCI and isolation monitoring), IEEE 1547-2003, IEEE 1547.1-2003, ANSI/IEEE C62.41, FCC Part 15 A & B, NEC Article 690, C22.2 No. 107.1-01 (September 2001), UL1699B Issue 2 2013, CSA TIL M-07 Issue 1 2013	UL 1741-2015, UL1998 (for functions: AFCI, RCMU and isolation monitoring), IEEE 1547-2003, IEEE 1547.1-2003, ANSI/IEEE C62.41, FCC Part 15 A & B, NEC Article 690-2014, C22.2 No. 107.1-01 (September 2001), UL1699B Issue 2 2013, CSA TIL M-07 Issue 1 2013

PROTECTIVE DEVICES	STANDARD WITH ALL PRIMO MODELS
AFCI & 2014 NEC Ready	Yes
Ground Fault Protection with Isolation Monitor Interrupter	Yes
DC disconnect	Yes
DC reverse polarity protection	Yes

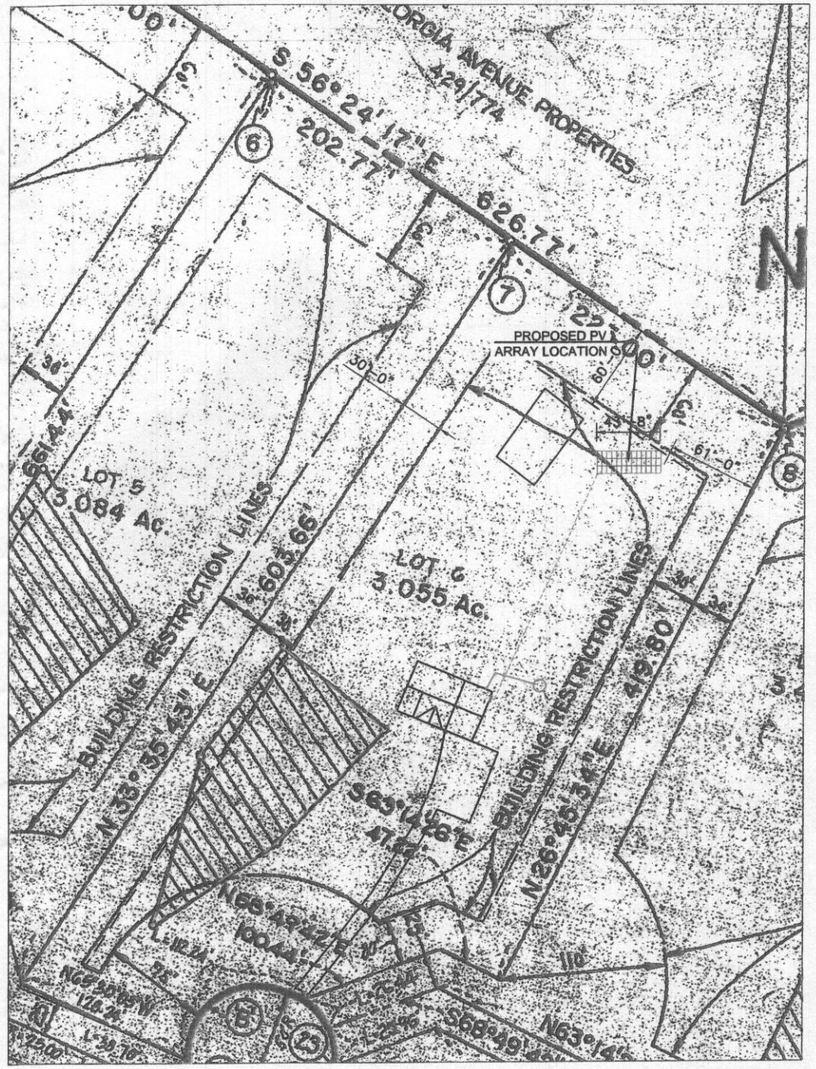
INTERFACES	STANDARD WITH ALL PRIMO MODELS
Wi Fi*/Ethernet/Serial	Wireless standard 802.11 b/g/n / Fronius Solar.web, SunSpec Modbus TCP, JSON / SunSpec Modbus RTU
6 inputs or 4 digital inputs/outputs	External relay controls
USB (A socket)	Datalogging and/or updating via USB
2x RS422 (RJ45 socket)	Fronius Solar Net, interface protocol
Datalogger and Webserver	Included

*The term Wi Fi® is a registered trademark of the Wi Fi Alliance.



SITE PLAN

Scale: 1" =50'



SITE PLAN

Scale: 1" =100'

N

S

NOTES:

1. THIS DRAWING IS TO PROVIDE REFERENCE FOR THE INSTALLATION OF GROUND MOUNT PHOTOVOLTAIC ARRAYS.
2. THE SYSTEM SHALL INCLUDE [39] TRINA SOLAR TSM-300DD05A.08(II) MODULES
3. PROPOSED ARRAYS SHALL COVER APROX. 655 SQ. FEET OF PROPERTY.

APPROVED

WALK-THRU BUILDING PERMIT

BP# _____ A# _____

APP. SAN DBurgard DATE: 2-26-18

DESC. OF WORK: Ground Mounted Solar Panels

General Notes

SolarEnergyWorld

Because Tomorrow Matters

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

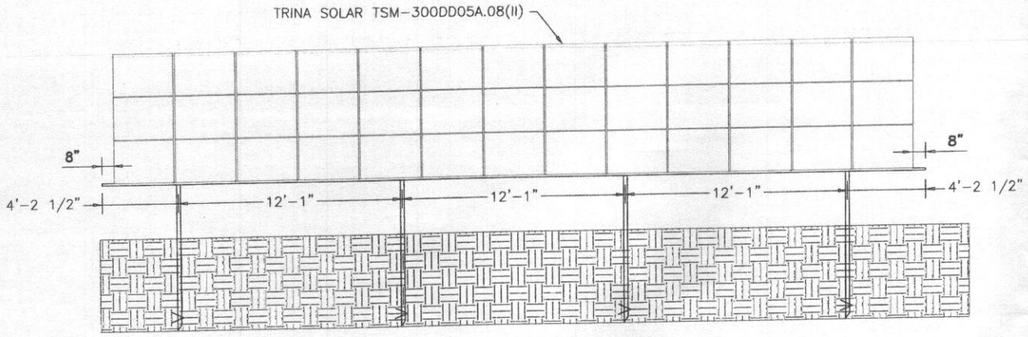
Stamp

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. 50459, EXPIRATION DATE:January 12, 2019.
*STAMPED AND SIGNED FOR STRUCTURES ONLY

Project Name and Address

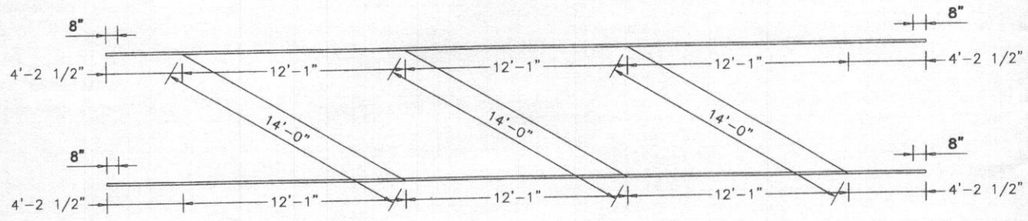
Stansbery, Harlan
16130 Patapsco Overlook Ct,
Mt Airy, MD 21771
11.70 kW

Drawn by	Sheet
DTK	A001
Date: 14-FEB-2018	
Scale: AS NOTED	



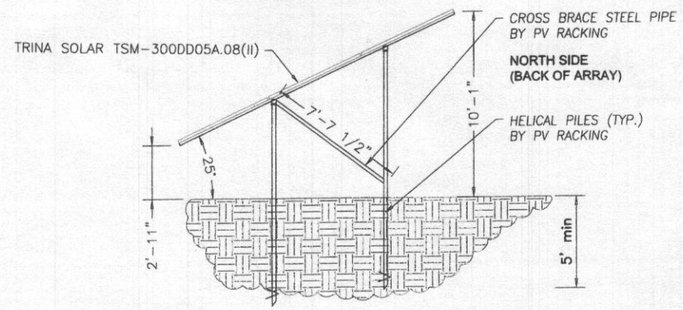
ARRAY FRONT ELEVATION

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



NOTES:

1. THIS DRAWING IS TO PROVIDE REFERENCE FOR THE INSTALLATION OF GROUND MOUNT PHOTOVOLTAIC ARRAYS.
2. PV RACKING FOR GROUND MOUNT WILL BE INSTALLED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS
3. LOAD CRITERIA PER IBC 2015 AND ASCE 7-10:
   RISK CATEGORY II
   EXPOSURE CATEGORY C
   GROUND SNOW LOAD, Pg = 30 PSF
   LATERAL LOAD:
   WIND LOADS (ULTIMATE DESIGN WIND SPEED = 115 MPH)



ARRAY SECTION

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

General Notes

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

Stamp

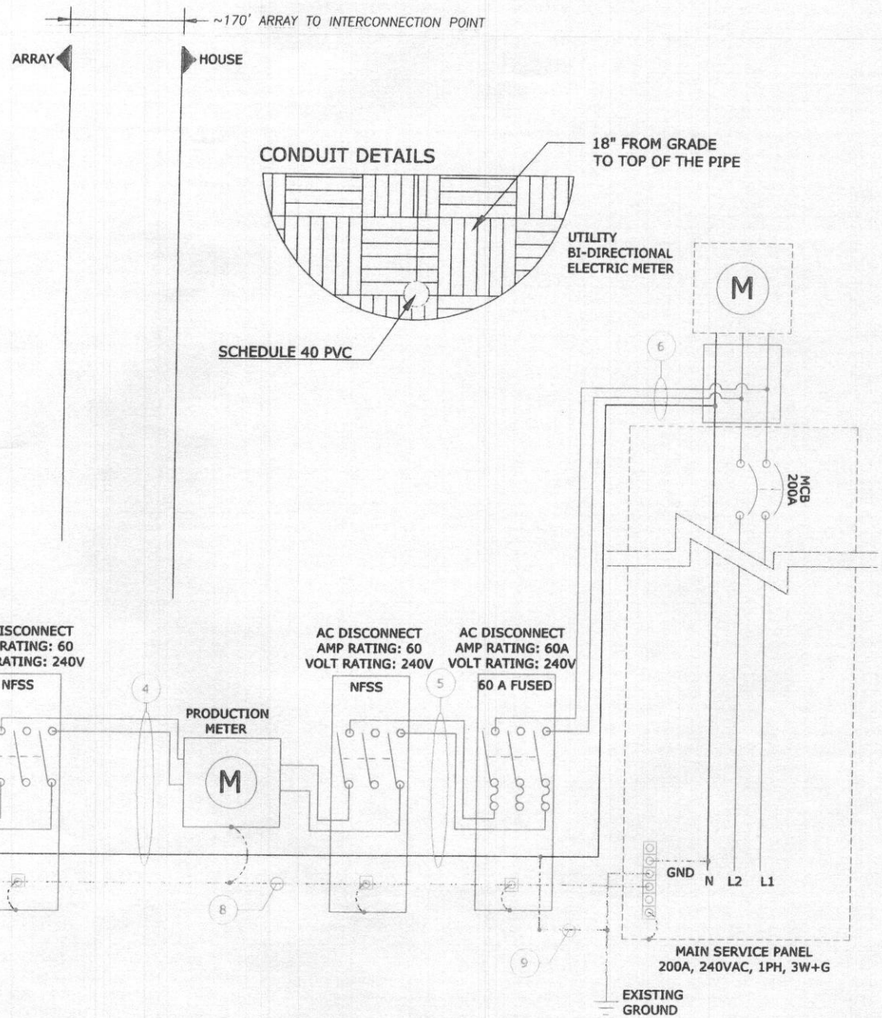
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 50459, EXPIRATION DATE:January 12, 2019.
*STAMPED AND SIGNED FOR STRUCTURES ONLY

Project Name and Address

Stansbery, Harlan
16130 Patapsco Overlook Ct,
Mt Airy, MD 21771
11.70 kW

Drawn by	Sheet
DTK	S001
Date: 14-FEB-2018	
Scale: AS NOTED	

MODULE SPECIFICATION		
MODEL NO.	TSM-300DD05A.08(II)	
PEAK POWER	300 W	
RATED VOLTAGE (Vmpp)	32.60 V	
RATED CURRENT (Imp)	9.19 A	
OPEN CIRCUIT VOLTAGE (Voc)	39.80 V	
SHORT CIRCUIT CURRENT (Isc)	9.77 A	
MAXIMUM SYSTEM VOLTAGE	1000VDC	
Inverters Spec's	FroniusPrimo 10.0-1	
Maximum DC Voltage	600 V	
Maximum Power Output	9995 W	
Nominal AC Voltage	240 VAC	
Maximum AC Current	41.6 A	
	ARRAY A DETAILS	
	MPPT 1	MPPT2
NO. OF MODULE PER STRING	10	9
NO. OF STRINGS	3	1
ARRAY WATTS AT STC	9000	2700
MAX. VOLTAGE	438	396
690.53 Label Info		
Rated Voltage	326 V	293.40 V
Rated Current	27.57 A	9.19 A
Maximum System Voltage	438.00 V	396.63 V
Short Circuit Current	36.64 A	12.21 A



WIRE/CONDUIT SCHEDULE ARRAY			
TAG	DESCRIPTION	WIRE SIZE/TYPE (A)	NOTES
1	Array to Transition Box	#10 USE-2	
2	Transition Box to DC Disconnect	#10 THWN/THWN-2; EMT	
3	DC Disconnect to Inverter	NA	Integrated
4	Inverter to AC Disconnect) Meter	#6 THWN/THWN IN PVC	2.85 % VD
5	Meter to AC Disconnect	#6 THWN/THWN IN EMT	
6	Fused AC Disconnect to Interconnection Point	#6 THWN/THWN IN EMT	
7	Bare Copper Wire	#10 Cu	
8	Equipment Grounding Conductor	#10 Cu	
9	Grounding Electrode Conductor	#8 Cu	To Existing Grounding Electrode
10	Grounding Electrode Conductor	#8 Cu OR #6 if exposed to physical damage	To Existing Grounding Electrode

GENERAL ELECTRICAL NOTES: NEC2014

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, 90ºC, 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. ASHRAE FUNDAMENTALS OUTDOOR DESIGN TEMPERATURES DO NOT EXCEED 47°C IN THE U.S. (PHOENIX, AZ or PALM SPRINGS, CA)
12. FOR LESS THAN 9 CURRENT-CARRYING CONDUCTORS IN ROOF MOUNTED SUNLIGHT CONDUIT USING THE OUTDOOR TEMPERATURE OF 47°C.
    - 12.1. 12AWG CONDUCTOR ARE GENERALLY ACCEPTABLE FOR MODULES WITH AN Isc OF 8.4 AMPS WITH A 10 AMP FUSE.
    - 12.2. 10AWG CONDUCTOR ARE GENERALLY ACCEPTABLE FOR MODULES WITH AN Isc OF 9.6 AMPS WITH A 15 AMP FUSE.
13. BREAKER SHALL BE INSTALLED IN ACCORDANCE WITH 690.64

Wire sizing for OCPD
Ex(Isc*(1.25)(1.25)(# of strings in parallel)= wire ampacity or using NEC table 690.8)

SolarEnergyWorld
5681 Main Street
Elkridge, MD 21075
(888) 497-3233

ENGINEER'S STAMP

Stansbery, Harlan
11.70 kW
16130 Patapsco Overlook Ct.
Mt Airy, MD 21771

SINGLE LINE DIAGRAM

REVISIONS			
REV	DESCRIPTION	DATE	DR CB

OPPORTUNITY
PROJECT
DATE DRAWN
DRAWN BY DS
DMS # REV #
SHEET E1