



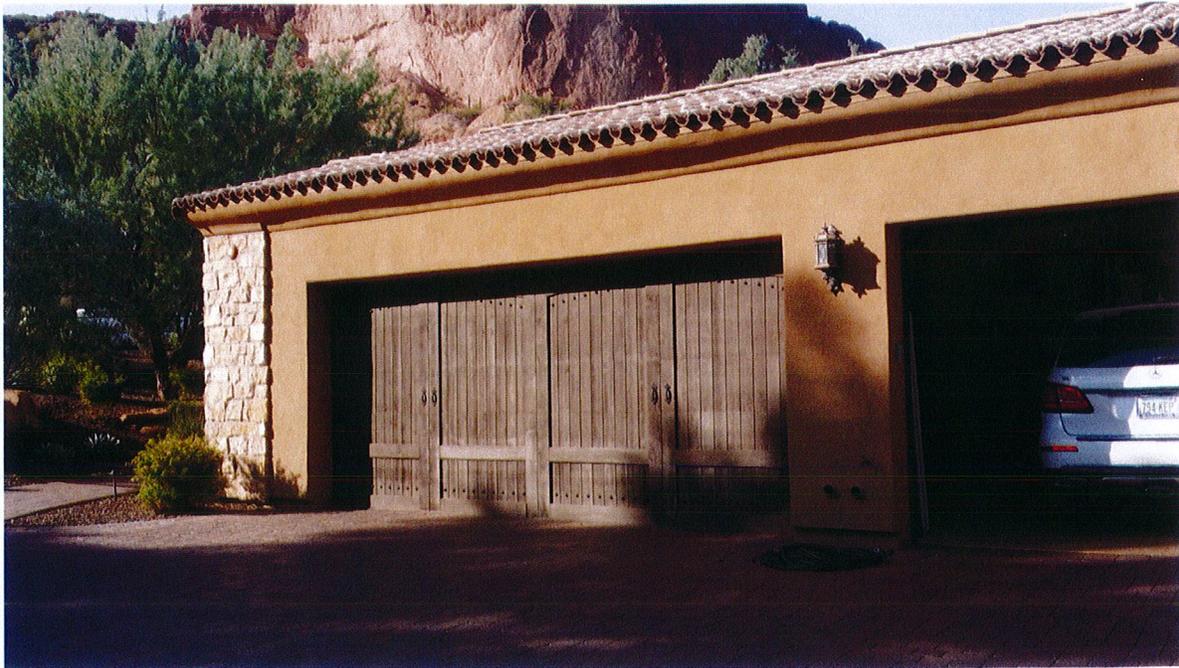
AERIAL PHOTOGRAPH OF THE INSTALLATION SITE



LOOKING TOWARD MOUNTING LOCATION #1



1) MOUNTING LOCATION #1



2) LOOKING TOWARD MOUNTING LOCATION #2



3) MOUNTING LOCATION #2

# PROJECT SUMMARY

## SCOPE OF WORK

TO INSTALL A SOLAR PHOTOVOLTAIC (PV) SYSTEM AT THE :  
 SOUTHERN STAR HOLDINGS RESIDENCE  
 LOCATED AT 5332 E. SOLANO DRIVE  
 IN PARADISE VALLEY, AZ 85253

THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT. THE PV SYSTEM INCLUDES DC RAPID SHUTDOWN DEVICES.

## GOVERNING CODES

- 2014 NATIONAL ELECTRIC CODE (NEC)
- 2015 INTERNATIONAL RESIDENTIAL CODE (IRC)
- 2012 INTERNATIONAL FIRE CODE (IFC)
- PLUS APPLICABLE CITY AMENDMENTS

## SHEET INDEX

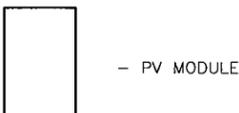
SHEET #	DRAWING
3002-8132	PROJECT SUMMARY & SITE PLAN
3002-8132-EL	MODULE MOUNTING ELEVATION
1002-0000	ELECTRICAL NOTES & KEY
1002-6690-3L	THREE-LINE ELECTRICAL DIAGRAM
2002-4689	ARRAY DIAGRAM
3002-8132-LOS-A	LINE OF SITE A
3002-8132-LOS-B	LINE OF SITE B

## BUILDING INFORMATION

BUILDING TYPE:	SINGLE FAMILY RESIDENCE
BUILDING HEIGHT:	ONE STORY
ROOF TYPE:	FOAMED LOW SLOPE ROOFS
FRAMING TYPE:	MANUFACTURED FLAT TRUSS
TRUSS SPACING:	24"
ROOF SLOPE:	LESS THAN 2'
ARRAY SLOPE:	0° TO 15° (DEPENDING ON PARAPET HEIGHT)
AZIMUTH 1 :	180°

## EQUIPMENT SUMMARY

EQUIP.	MFG	MODEL #	QTY.
PV MODULE	HYUNDAI	HiS-S280RG-(BK)	20
PV INVERTER	SMA AMERICA	SB6.0-1SP-US-40	1
RS CONTROLLER	SMA AMERICA	RSC-1X-US	1
RS BOX	SMA AMERICA	RSB-2S-US	2



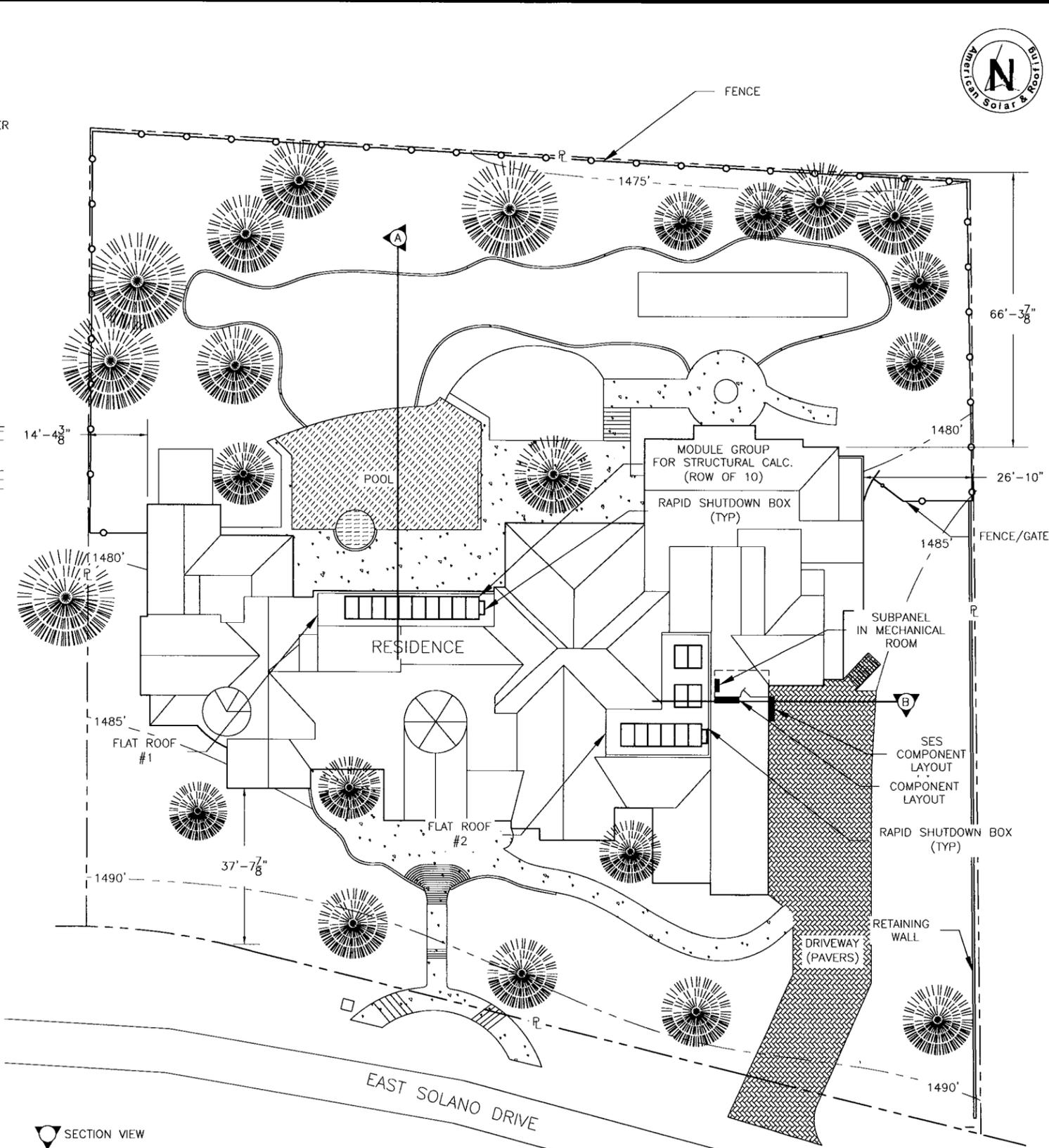
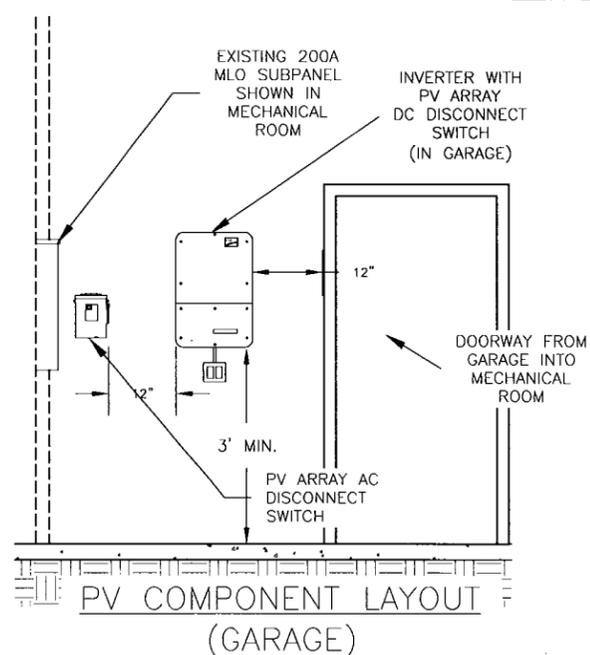
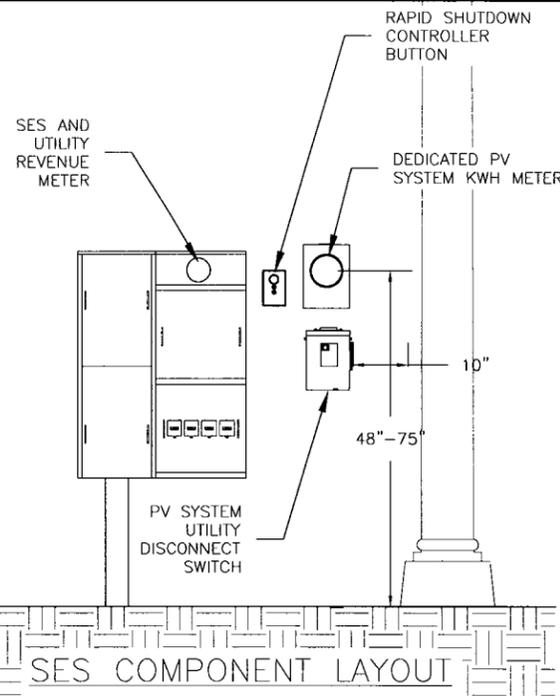
THE STATED CLEARANCES ARE MANUFACTURER OR UTILITY REQUIREMENTS. CONSULT SECTION 110.26 OF THE NEC FOR OTHER "WORKING SPACE" REQUIREMENTS.

DIMENSIONS ARE MINIMUM CLEARANCES REQUIRED AND MAY NOT REFLECT THE ACTUAL INSTALLED LOCATION.

OVERCURRENT DEVICES SHALL BE READILY ACCESSIBLE AND INSTALLED SO THAT THE CENTER OF THE OPERATING HANDLE, (SWITCH OR CIRCUIT BREAKER) SHALL NOT BE MORE THAN 79" ABOVE THE FINISHED FLOOR OR GRADE.

### NOTE

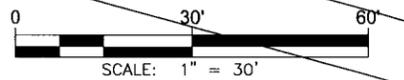
- UTILITY HAS 24-HOUR UNRESTRICTED ACCESS TO ALL PV SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
- WORKSPACE IN FRONT OF THE AC ELECTRICAL COMPONENTS SHALL BE IN ACCORDANCE WITH APS AND NEC REQUIREMENTS.
- VERIFY ELECTRIC METER SEPARATION BETWEEN WATER AND GAS AS REFERENCED IN SECTION 301.15 OF THE APS ESRM.



SECTION VIEW

**GENERAL NOTE:**  
 NO VENTS, PIPES, OR EXHAUST SHALL BE COVERED BY THE SOLAR ARRAY.

JURISDICTION: PARADISE VALLEY  
 APN: 172-47-023  
 ZONING: R-43  
 LOT SIZE: 45,546 SQ-FT  
 SUBDIVISION: STONE CANYON  
 LOT: 23  
 CONSTRUCTION YEAR: 2007  
 RESIDENCE SQ-FT: 8,499 SQ-FT



**AMERICAN**  
 SOLAR &  
 ROOFING

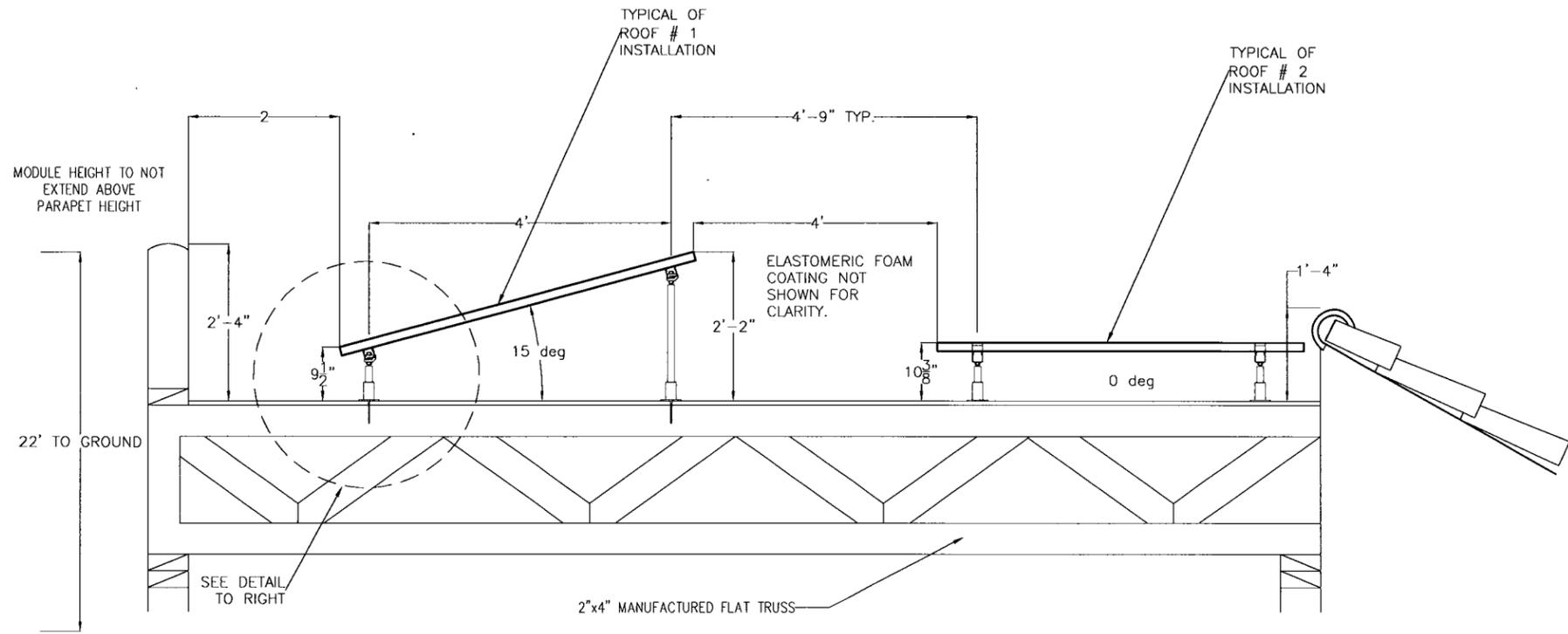
AZ ROC License # 168657(CR-1), #236520(CR-42)  
 1230 W 23rd Street  
 Tempe, AZ 85282  
 [480] 994-1440, [480] 994-1438 Fax  
 ASE PROJECT # 05025-PV

REVISIONS	DATE	DESIGNER

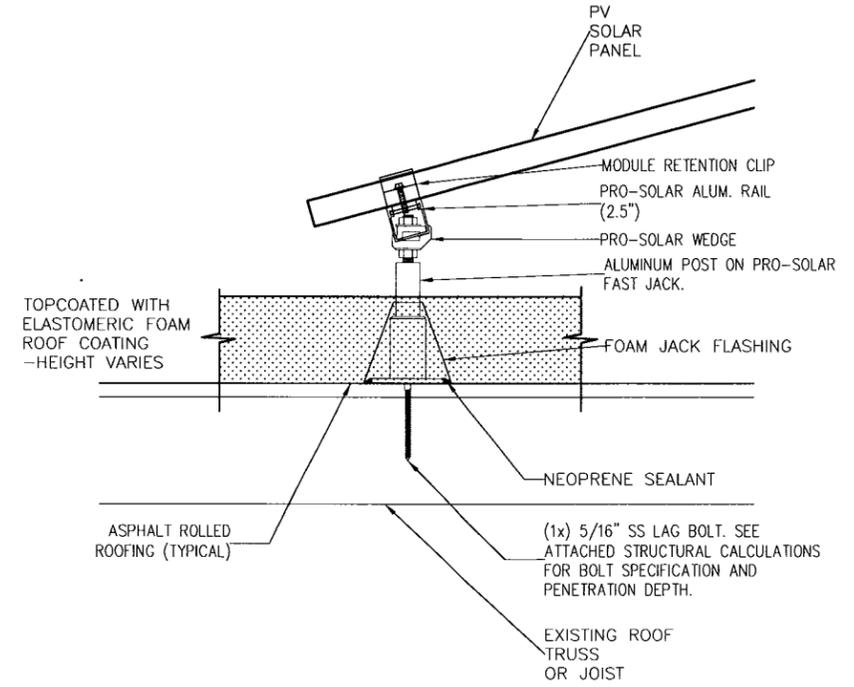
SOLUTIONS ASSOC.	JOSH S.	DAVE S.	MIKE R.
DESIGNER			
PROJECT MGR.			

PROJECT INFORMATION	QUOTE VERSION	UTILITY	DO NOT SCALE
D	AHJ	APS	DRAWINGS
P. VALLEY			
12/29/2016			
3002-8132			

PROJECT SUMMARY & SITE PLAN  
 6.0kW<sub>ac</sub>/5.6kW<sub>dc</sub> PHOTOVOLTAIC SYSTEM  
 5332 EAST SOLANO DRIVE  
 PARADISE VALLEY, ARIZONA 85253  
 CUSTOMER: SOUTHERN STAR HOLDINGS



**FAST JACK AND TILT STANDARD DETAIL**

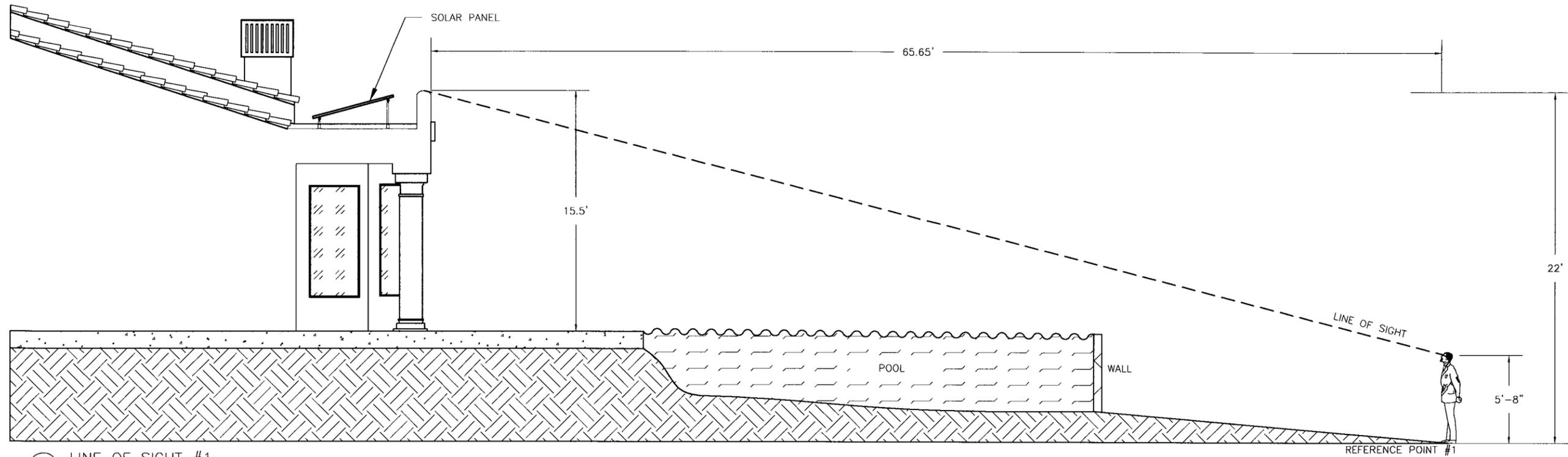


REVISIONS	DATE	DESIGNER

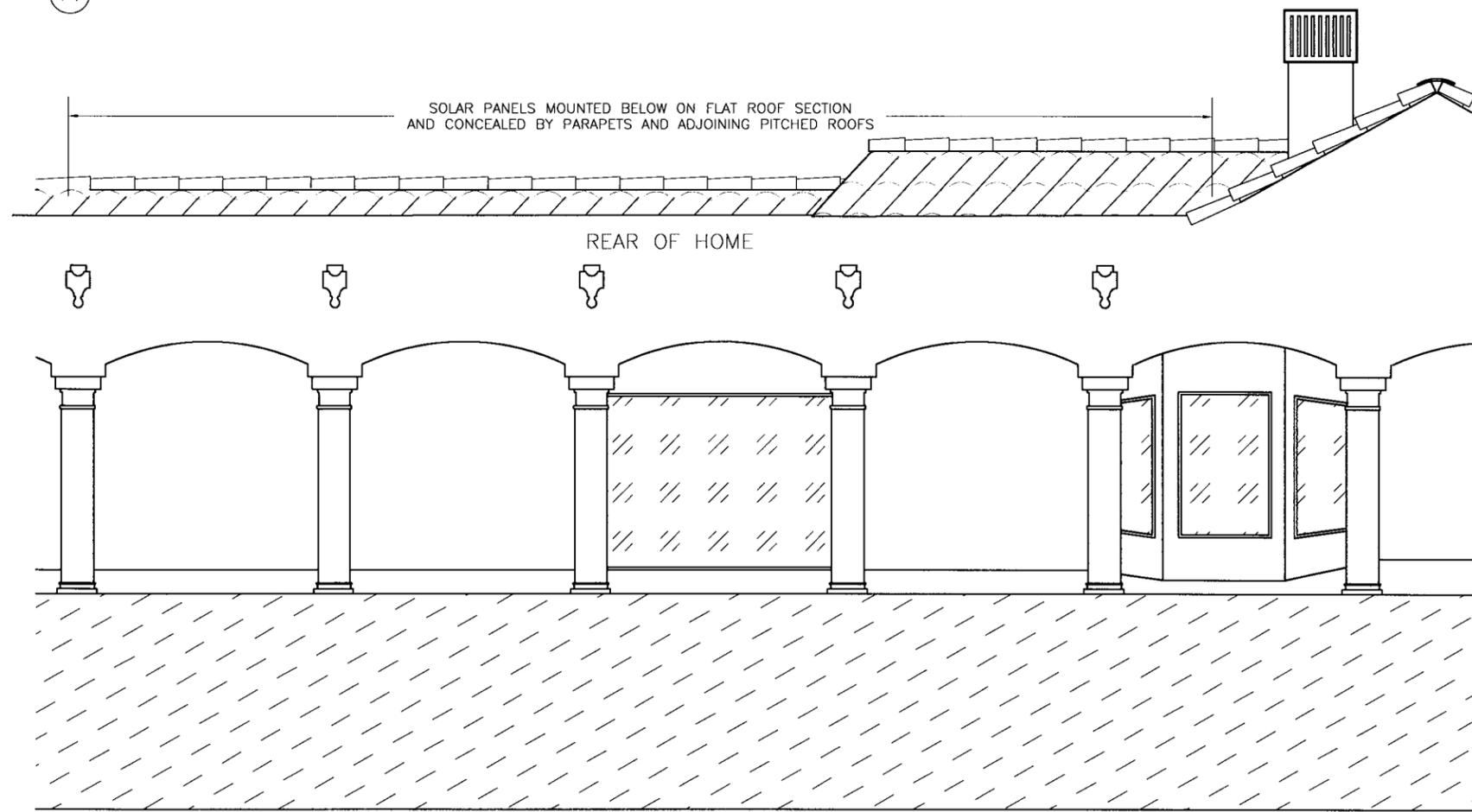
  

PROJECT INFORMATION	SOLUTIONS ASSOC.	JOSH S.
QUOTE VERSION	DESIGNER	DAVE S.
AHJ	PROJECT MGR.	MIKE R.
UTILITY	DESIGN DATE	12/29/2016
DO NOT SCALE	DRAWINGS	SHEET NUMBER: 3002-8132-EL

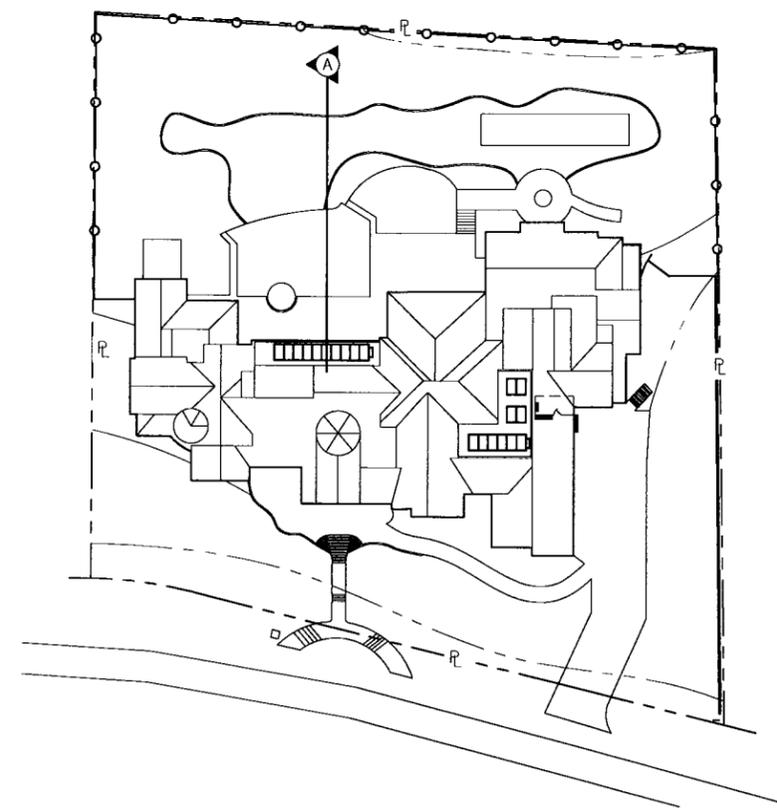
**MODULE ELEVATION**  
6.0kW<sub>ac</sub>/5.6kW<sub>dc</sub> PHOTOVOLTAIC SYSTEM  
5332 EAST SOLANO DRIVE  
PARADISE VALLEY, ARIZONA 85253  
CUSTOMER: SOUTHERN STAR HOLDINGS



(A) LINE OF SIGHT #1



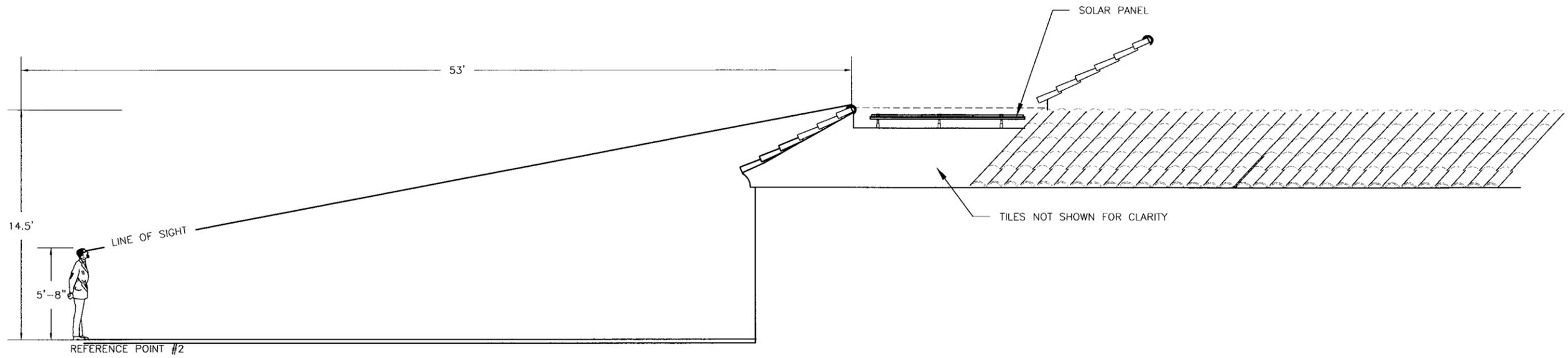
(B) APPROXIMATE ELEVATION VIEW FROM POINT #1



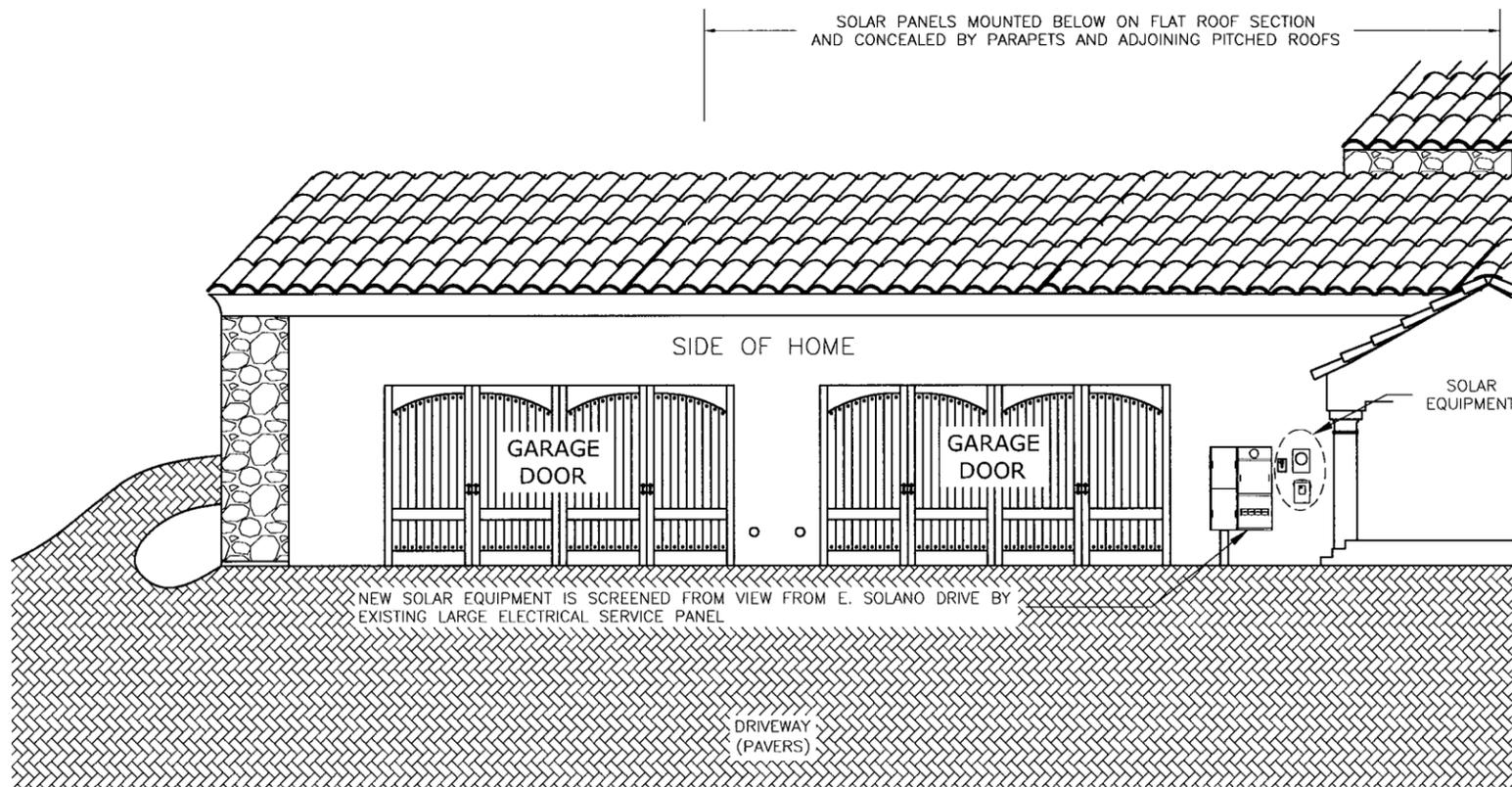
REV	DESIGNER	DATE
1	DAVE S.	
2	MIKE R.	12/29/2016

PROJECT INFORMATION	SOLUTIONS ASSOC.	JOSH S.
QUOTE VERSION D	DESIGNER	DAVE S.
UTILITY AP-J	PROJECT MGR.	MIKE R.
DO NOT SCALE	DESIGN DATE	12/29/2016
DRAWINGS	SHEET NUMBER	3002-8132-LOS-A

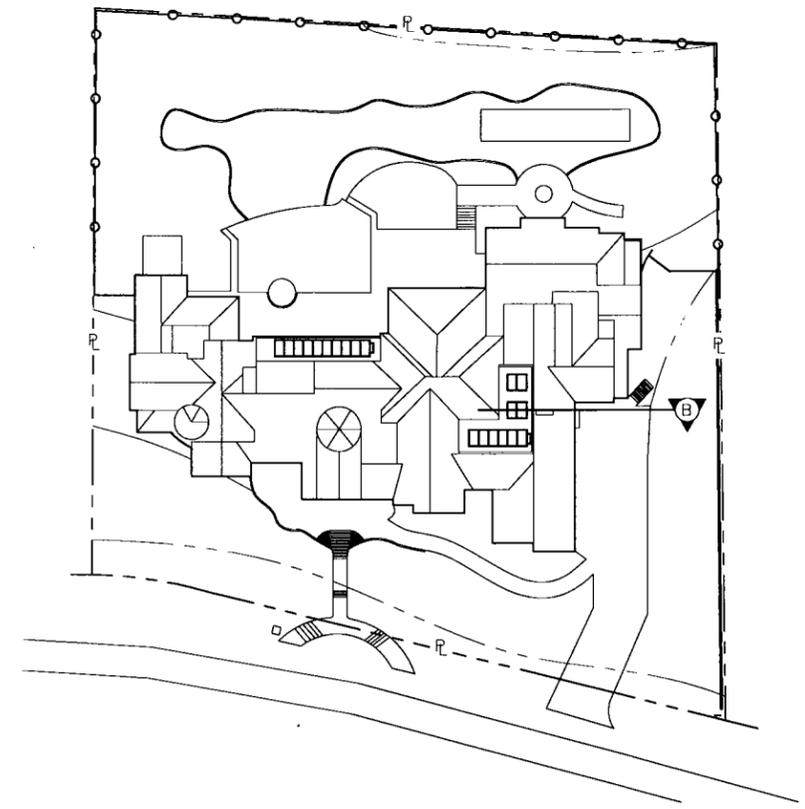
**LINE OF SIGHT 1**  
6.0kW<sub>ac</sub>/5.6kW<sub>dc</sub> PHOTOVOLTAIC SYSTEM  
5332 EAST SOLANO DRIVE  
PARADISE VALLEY, ARIZONA 85253  
CUSTOMER: SOUTHERN STAR HOLDINGS



C LINE OF SIGHT #2



D APPROXIMATE ELEVATION VIEW FROM POINT #2



REVISIONS		JOSH S.	DAVE S.	DATE
REV	DESIGNER	DATE	DATE	DATE
1	DAVE S.	12/29/2016		
2	MIKE R.			

PROJECT INFORMATION  
SOLUTIONS ASSOC. DESIGNER  
D P. VALLEY  
PROJECT MGR. APS  
DESIGN DATE 12/29/2016  
SHEET NUMBER: 3002-8132-LOS-B

PROJECT INFORMATION  
QUOTE VERSION D  
UTILITY DO NOT SCALE DRAWINGS

6.0kW<sub>ac</sub>/5.6kW<sub>dc</sub> PHOTOVOLTAIC SYSTEM  
5332 EAST SOLANO DRIVE  
PARADISE VALLEY, ARIZONA 85253  
CUSTOMER: SOUTHERN STAR HOLDINGS

REVISIONS	DATE	DESIGNER
REV	DATE	DESIGNER

JOSH S.	DAVE S.	MIKE R.

SOLUTIONS ASSOC.	DESIGNER	PROJECT MGR.	DESIGN DATE	SHEET NUMBER
			12/29/2016	1002-0000

**ELECTRICAL NOTES AND KEY**  
6.0kW<sub>ac</sub>/5.6kW<sub>dc</sub> PHOTOVOLTAIC SYSTEM  
5332 EAST SOLANO DRIVE  
PARADISE VALLEY, ARIZONA 85253  
CUSTOMER: SOUTHERN STAR HOLDINGS

**SYMBOL & ABBREVIATION KEY**

IRREVERSIBLE BOND	⊥
SPLICE	•
GROUNDING ELECTRODE CONDUCTOR	GEC
GROUND FAULT PROTECTION DEVICE	GFPD
ARC FAULT CIRCUIT INTERRUPTER	AFCI
SECURE POWER SYSTEM	SPS
MAIN CIRCUIT BREAKER	MCB
MAIN LUG ONLY	MLO
OVERCURRENT PROTECTION DEVICE	OCPD
PHOTOVOLTAIC	PV
SERVICE ENTRANCE SECTION	SES
NEUTRAL	NEU.
GROUND	GND.

**ELECTRICAL CALCULATIONS**

690.7: MAXIMUM SYSTEM VOLTAGE (DC)  
38.5V x 10 x 1.14 = 438.90V

690.8(A)(1): MAXIMUM PV SOURCE CIRCUIT CURRENT (DC)  
9.4A x 1 x 1.25 = 11.75A

690.8(B)(1): SIZING OF CONDUCTORS  
11.75A x 1.25 = 14.69A

DC CONDUCTOR AMPACITY CALCULATIONS:  
10AWG CU = 40A @ 90°C  
40A x .8 X 0.71 (EXTREME ATTIC CONDITIONS) = 22.72A  
22.72A > 14.69A, THEREFORE 10 AWG CU IS SUFFICIENT.

690.8(A)(3): INVERTER OUTPUT CIRCUIT CURRENT  
25A x 1.25 = 31.25A or 6000W/240V x 1.25 = 31.25A

AC CONDUCTOR AMPACITY CALCULATIONS:  
8 AWG CU = 55A @ 90°C  
55A x 1 x 0.87 = 47.85A  
47.85A > 31.25A, THEREFORE 8 AWG CU IS SUFFICIENT.

705.12(D)(2): BACKFEED BREAKER CALCULATION:  
BUS BAR RATING: 200A  
FUSE RATING: 200A  
200A x 1.2 = 240A - 200 = 40A MAX BACKFEED

31.25A (INVERTER OUTPUT CIRCUIT CURRENT) < 40A  
THEREFORE 35A BREAKER IS SUFFICIENT.

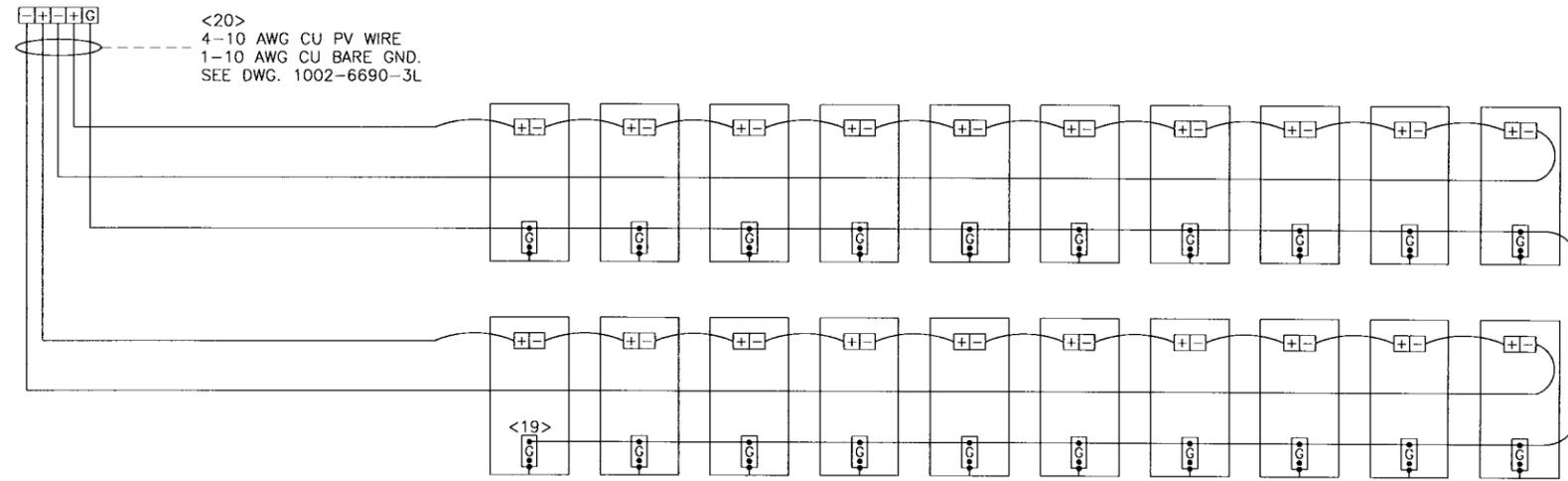
NOTES

- 1 ALL EQUIPMENT TO BE INSTALLED IN ACCORDANCE WITH 2014 NEC AND 2015 IRC REQUIREMENTS AND APPLICABLE CITY AMENDMENTS.
- 2 DASHED LINES DENOTE EXISTING EQUIPMENT. SOLID LINES DENOTE EQUIPMENT INSTALLED BY AMERICAN SOLAR.
- <3> BI-DIRECTIONAL METER TO BE INSTALLED BY UTILITY IF REQUIRED.
- <4> LABEL BREAKER/FUSE WITH "PHOTOVOLTAIC POWER SOURCE", THE RATED AC OUTPUT CURRENT AND THE NOMINAL OPERATING AC VOLTAGE PER NEC 690.54. LABEL "BREAKER/FUSE IS BACKFED" PER NEC 705.12(D)(3)&(4).
- <5> THE OVERCURRENT PROTECTION DEVICE (OCPD) FOR THE PHOTOVOLTAIC (PV) SYSTEM SHALL BE POSITIONED AT THE OPPOSITE (LOAD) END FROM THE INPUT FEEDER LOCATION OR MAIN CIRCUIT BREAKER. LABEL PV SYSTEM OCPD "WARNING INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE". PER 705.12(D)(2.3b).
- <6> LABEL "BREAKER/FUSE HAS BEEN DE-RATED" PURSUANT TO NEC 705.12(D)(2)".
- <7> LABEL "WARNING A GENERATION SOURCE IS CONNECTED TO THE SUPPLY (UTILITY) SIDE OF THE MAIN SERVICE DISCONNECT. FOLLOW PROPER LOCK-OUT/TAG-OUT PROCEDURES TO ENSURE THE PV SYSTEM UTILITY DISCONNECT SWITCH IS OPENED PRIOR TO PERFORMING WORK ON THIS DEVICE."
- <8> LABEL "PHOTOVOLTAIC SYSTEM UTILITY DISCONNECT SWITCH". SWITCH TO BE LOCKED. SWITCH TO BE VISIBLE BLADE DISCONNECT PER UTILITY REQUIREMENTS AND CONFORM TO NEC 705.22.
- <9> PROVIDE WARNING SIGN PER NEC 690.17(E) READING "WARNING ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION." LABEL SHALL CONFORM TO NEC 110.21(B).
- <10> LABEL "PHOTOVOLTAIC SYSTEM DEDICATED KWH METER".
- <11> LABEL "DO NOT ADD LOADS TO COMBINER PANEL".
- 12 POWER INVERTER AND SOLAR MODULES SHALL BE INSTALLED AND USED IN ACCORDANCE WITH ANY INSTRUCTIONS INCLUDED IN THE LISTING OR LABELING PER NEC 110.3(B).
- <13> LABEL "PHOTOVOLTAIC ARRAY DC DISCONNECT SWITCH" PER NEC 690.15. FOR X NUMBER OF DC DISCONNECTS, ADD "1 OF X", "2 OF X", ETC.  
LABEL SWITCH WITH RATED MAXIMUM POWER-POINT CURRENT, RATED MAXIMUM POWER-POINT VOLTAGE, MAXIMUM SYSTEM VOLTAGE, AND SHORT-CIRCUIT CURRENT PER NEC 690.53. SWITCH TO BE LOCKED PER NEC 690.7(D).
- <14> GROUND FAULT PROTECTION DEVICE (1A, 600VDC) LOCATED INSIDE INVERTER PER NEC 690.5. PROVIDE LABEL PER NEC 690.5(C) READING "WARNING ELECTRIC SHOCK HAZARD IF A GROUND FAULT IS INDICATED, NORMALLY GROUNDED CONDUCTOR MAY BE UNGROUNDED AND ENERGIZED."
- <15> ARC-FAULT CIRCUIT PROTECTION LOCATED INSIDE INVERTER PER NEC 690.11.
- <16> GROUNDING ELECTRODE CONDUCTOR MUST TIE INTO AC GROUNDING ELECTRODE SYSTEM AND BE INSTALLED IN ACCORDANCE WITH NEC 250.64, AND 690.47(C)(2). CONDUCTORS MUST BE CONTINUOUS AND CONNECTIONS MUST BE IRREVERSIBLE.
- 17 ALL PV SOURCE CIRCUIT CONDUCTORS TO BE 10 AWG PV WIRE UNLESS OTHERWISE SPECIFIED. WIRE MAY BE RUN SHORT DISTANCES OUTSIDE OF CONDUIT IF WIRE READS "SUNLIGHT RESISTANT". CONDUCTORS SHALL MEET IDENTIFICATION REQUIREMENTS OF NEC 210.5(C) & 215.12(C)
- 18 ALL ARRAY EQUIPMENT GROUNDING CONDUCTORS TO BE 10 AWG BARE COPPER WIRE (SOLID) UNLESS OTHERWISE SPECIFIED.
- <19> ALL MODULE GROUND CONNECTIONS TO BE MADE USING STAINLESS STEEL HARDWARE.
- 20 FOLLOW MANUFACTURERS SUGGESTED INSTALLATION PRACTICES ON ALL SERIES WIRING TERMINATIONS.
- 21 DC SYSTEM TO BE GROUNDED PER NEC 250.97, BONDING OVER 250V.
- <22> PHOTOVOLTAIC SOURCE CIRCUITS, PHOTOVOLTAIC OUTPUT CIRCUITS, INVERTER INPUT AND OUTPUT CIRCUITS SHALL BE IDENTIFIED AT ALL POINTS OF TERMINATION, CONNECTION AND SPLICES, PER NEC 690.31(B)(1)(2)&(3).
- <23> DIRECT CURRENT PHOTOVOLTAIC SOURCE AND OUTPUT CIRCUITS RUN INSIDE A BUILDING OR STRUCTURE SHALL BE INSTALLED CONTAINED IN METAL RACEWAYS AND LABELED "WARNING: PHOTOVOLTAIC POWER SOURCE" PER NEC 690.31(G)(3)&(4).
- <24> INSTALL "RAPID SHUTDOWN" EQUIPMENT PER NEC 690.12 & 690.15(C). PROVIDE LABEL "PHOTOVOLTAIC SYSTEM WITH RAPID SHUTDOWN" PER NEC 690.56(B).
- 25 ALL LABELS SHALL CONFORM TO NEC 110.21(B).
- 26 ALL TERMINATIONS TO BE RATED MINIMUM 75°C PER NEC 110.14(C)(1)

NOTES DENOTED WITH < > ARE "KEYED" NOTES AND ARE REFERENCED WHERE THEY APPLY.  
ALL OTHER "NON-KEYED" NOTES SHALL BE CONSIDERED GENERAL NOTES.



TOTAL SYSTEM DC WATTAGE: 5.60 kW



2800 WATT PV STRING A  
MFR. HYUNDAI, MODEL HIS280RG(BK)  
10 IN SERIES BY 1 IN PARALLEL  
 $VOC=38.5V \times 10 \times 1.14 = 438.90V$   
 $VMP=31.7V \times 10 = 317.00V$   
 $ISC=11.75A, IMP=8.80A$

2800 WATT PV STRING B  
MFR. HYUNDAI, MODEL HIS280RG(BK)  
10 IN SERIES BY 1 IN PARALLEL  
 $VOC=38.5V \times 10 \times 1.14 = 438.90V$   
 $VMP=31.7V \times 10 = 317.00V$   
 $ISC=11.75A, IMP=8.80A$

SEE NOTES ON DWG. 1002-0000

**AMERICAN**  
SOLAR &  
ROOFING

AZ ROC License #168657[CR-1.], #236520[CR-42]  
1230 W 23rd Street  
Tempe, AZ 85282  
[480] 994-1440, [480] 994-1438 Fax  
ASE PROJECT # 05025-PV

PROJECT INFORMATION		SOLUTIONS ASSOC.		REVISIONS		
QUOTE VERSION	DESIGNER	DESIGNER	PROJECT MGR.	REV	DESIGNER	DATE
AHJ	D	JOSH S.	DAVE S.			
UTILITY	P.VALLEY	DAVE S.	MIKE R.			
DO NOT SCALE	APV	12/29/2016	2002-4689			
DRAWINGS	SHEET NUMBER:					

ARRAY DIAGRAM  
6.0kW<sub>ac</sub>/5.6kW<sub>dc</sub> PHOTOVOLTATIC SYSTEM  
5332 EAST SOLANO DRIVE  
PARADISE VALLEY, ARIZONA 85253  
CUSTOMER: SOUTHERN STAR HOLDINGS



# Hyundai Solar Module

Hyundai Heavy Industries was founded in 1972 and is a Fortune 500 company. The company employs more than 48,000 people, and has a global leading 7 business divisions with sales of 40.9 Billion USD in 2015. As one of our core businesses of the company, Hyundai Heavy Industries is committed to develop and invest heavily in the field of renewable energy.

Hyundai Solar is the largest and the longest standing PV cell and module manufacturer in South Korea. We have 800 MW of module production capacity and provide high-quality solar PV products to more than 3,000 customers worldwide. We strive to achieve one of the most efficient PV modules by establishing an R&D laboratory and investing more than 20 Million USD on innovative technologies.

## Black-Black RG-Series

### Poly-crystalline Type

HiS-M255RG (BK) | HiS-M260RG (BK) | HiS-M265RG (BK) | HiS-M270RG (BK)

### Mono-crystalline Type

HiS-S275RG (BK) | HiS-S280RG (BK) | HiS-S285RG (BK) | HiS-S290RG (BK)

## Mechanical Characteristics

Dimensions	998 mm (39.29")(W) × 1,640 mm (64.57")(L) × 35 mm (1.38")(H)
Weight	Approx. 18.7 kg (41.2 lbs)
Solar cells	60 cells in series (6 × 10 matrix) (Hyundai cell, Made in Korea)
Output cables	4 mm <sup>2</sup> (12AWG) cables with polarized weatherproof connectors, IEC certified (UL listed and UL 4703 certified), Length 1.0 m (39.4")
Junction box	IP67, weatherproof, IEC certified (UL listed)
Bypass diodes	3 bypass diodes to prevent power decrease by partial shade
Construction	Front : Anti-reflection coated glass, 3.2 mm (0.126") Encapsulant : EVA      Back Sheet : Weatherproof film (Black)
Frame	Clear anodized aluminum alloy type 6063 (Black)

## High Quality

- IEC 61215 (Ed.2) and IEC 61730 by VDE
- UL listed (UL 1703), Type 1 for Class A Fire Rating
- Output power tolerance +3/-0 %
- ISO 9001:2008, ISO 14001:2004 and ISO 50001:2011 Certified
- OHSAS 18001:2007 Certified
- Advanced Mechanical Test (5,400 Pa) Passed (IEC 61215)  
/ Mechanical Load Test (40 lbs/ft<sup>2</sup>) Passed (UL)
- IEC 62716 (Ammonia Corrosion Resistance Test) Passed
- IEC 61701 (Salt Mist Corrosion Test) Passed
- Potential-Induced Degradation (PID) Test Passed  
(85°C / 85 % / 600 hr-PVEL)

## Accredited Test Lab

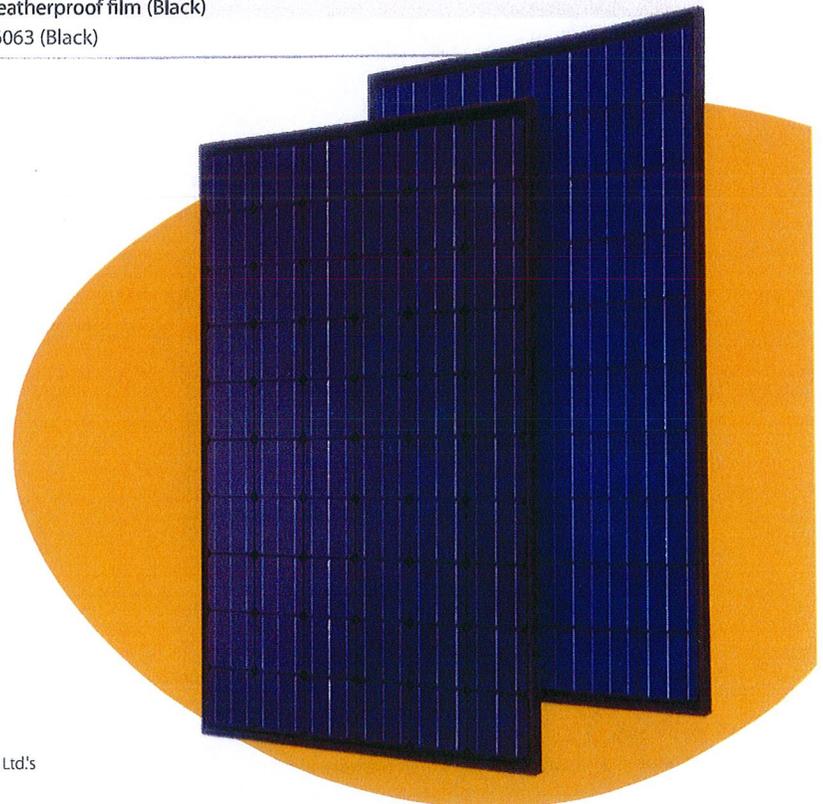
- VDE (Test Data Acceptance Program)
- UL (Witness Test Data Program)

## Limited Warranty

- 1st year: 97 %
- After 2nd year: 0.7 % annual degradation  
80.2 % for 25 years
- ▶ Please refer to the Hyundai Limited Warranty for more details.

### ※ Important Notice on Warranty

The warranties apply only to the PV modules with Hyundai Heavy Industries Co., Ltd.'s logo (shown below) and product serial number on it.



# Electrical Characteristics

## Poly-crystalline Type

		HIS-M□□□RG (BK)			
		255	260	265	270
Nominal output (Pmpp)	W	255	260	265	270
Voltage at Pmax (Vmpp)	V	31.0	31.1	31.3	31.4
Current at Pmax (Impp)	A	8.2	8.4	8.5	8.6
Open circuit voltage (Voc)	V	37.6	37.7	37.9	38.0
Short circuit current (Isc)	A	8.8	8.9	9.1	9.2
Output tolerance	%	+3/-0			
No. of cells & connections	pcs	60 in series			
Cell type	-	6" Poly-crystalline silicon			
Module efficiency	%	15.6	15.9	16.2	16.5
Temperature coefficient of Pmpp	%/K	-0.41			
Temperature coefficient of Voc	%/K	-0.32			
Temperature coefficient of Isc	%/K	0.039			

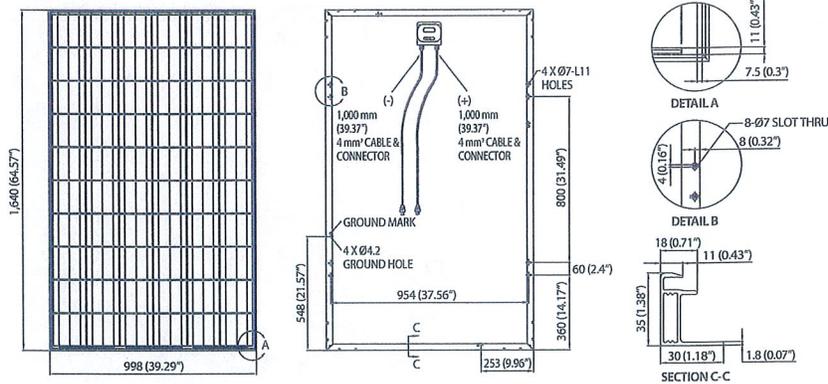
※ All data at STC (Standard Test Conditions). Above data may be changed without prior notice.

## Mono-crystalline Type

		HIS-S□□□RG (BK)			
		275	280	285	290
Nominal output (Pmpp)	W	275	280	285	290
Voltage at Pmax (Vmpp)	V	31.6	31.7	31.8	32.0
Current at Pmax (Impp)	A	8.7	8.8	8.9	9.1
Open circuit voltage (Voc)	V	38.4	38.5	38.7	38.8
Short circuit current (Isc)	A	9.3	9.4	9.5	9.7
Output tolerance	%	+3/-0			
No. of cells & connections	pcs	60 in series			
Cell type	-	6" Mono-crystalline silicon			
Module efficiency	%	16.8	17.1	17.4	17.7
Temperature coefficient of Pmpp	%/K	-0.42			
Temperature coefficient of Voc	%/K	-0.30			
Temperature coefficient of Isc	%/K	0.047			

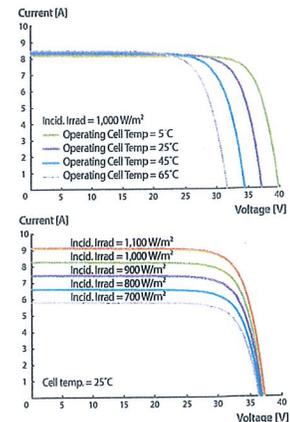
※ All data at STC (Standard Test Conditions). Above data may be changed without prior notice.

## Module Diagram



(unit : mm, inch)

## I-V Curves



## Installation Safety Guide

- Only qualified personnel should install or perform maintenance.
- Be aware of dangerous high DC voltage.
- Do not damage or scratch the rear surface of the module.
- Do not handle or install modules when they are wet.

Nominal Operating Cell Temperature	46°C ± 2
Operating Temperature	-40 - 85°C
Maximum System Voltage	DC 1,000 V (IEC) DC 1,000 V (UL)
Maximum Reverse Current	15 A

[ Printed Date : August 2016 ]

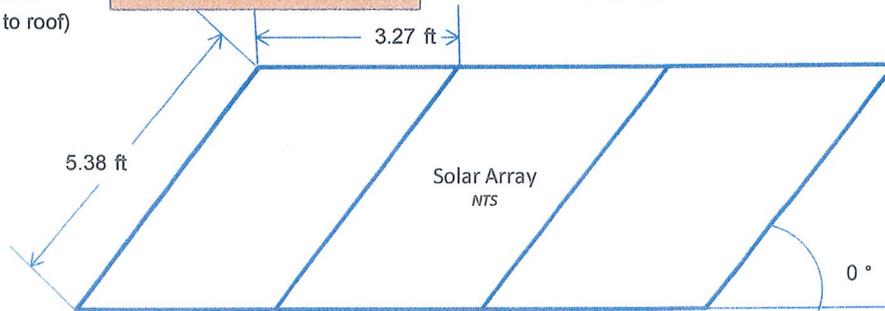


## Uplift and Shear Calculations for Attachment to Wood Joists

Panel Grouping Identification #

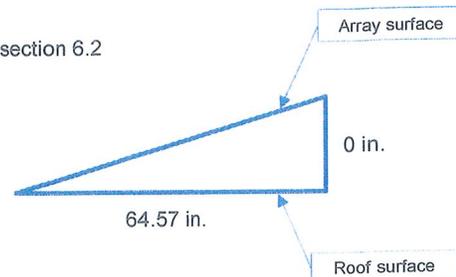
### Uplift and Shear Calculations for Attachment to Wood Joists

Module: Hyundai HiS-S280RG-(BK)  
 Length: 64.57 in.  
 Width: 39.29 in.  
 Mounting Style: Portrait (in.)  
 Vertical Support: Solar Wedge, 15 degree Height: 4.5  
 Horizontal Support: ProSolar Rail, 2.5" deep Height: 2.5  
 Mount Thickness: 1.25 in. \*This is the thickness the screw has to go through to get to the roof.  
 Dead Load: 2.8 psf  
 Member Depth: 3.5 in.  
 High Temperature: Record High > 100 degrees  
 Plywood Thickness: 0.5 in.  
 Rail Orientation: Rails Perpendicular to Joists/Trusses  $\theta = 0^\circ$   
 Spacing of Supports: 4.00 ft. 0.000 radians  
 Angle of Panel: 0°  
 (w/ respect to roof)

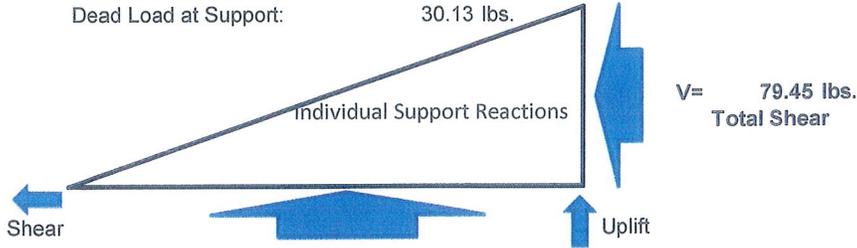


Building Code: 2012 IRC  
 Basic Wind Speed: 90 mph IRC Figure 301.2(4)  
 Mean Roof Height: 22.00 ft  
 Roof Height for uplift tbl: 25 ft  
 Roof Pitch: Roof > 0°-10°  
 Exposure: C  
 Roof Zone: 3 \*IRC Figure R301.2(7)  
 Effective Wind Area: 21.5233 sq. ft. \*ASCE 7-10, section 6.2  
 Vertical Wind Area: 0.46 sq. ft.  
 Horizontal Wind Area: 5.381 sq. ft.  
 Eff. Wind Area in Table: 20 sq. ft.  
 T.O. Array above Roof: 0.000 ft.  
 Height for Wind table: 25 ft.  
 Dist. btwn. support rails: 4.00 ft.

Values from R301.2(2)	max +	max -
Roof Pressures:	10	-30.5 (psf)
Normal Wind on Walls:	13.9	-18.2 (psf)
Total Normal Wind:	32.1 psf	
Wind normal to roof Height+Exposure Coeff:	1.35 *IRC Table R301.2(3)	
Wind Pressure Height+Exposure Coeff:	1.35	



Total Wind Force: 43.335 psf  
 Total Wind Pressure: 41.175 psf  
 Dead Load at Support: 30.13 lbs.



Total Uplift = 886.22 lbs.

Shear = 39.72 lbs.

uplift normal = -13.53 lbs.  
 uplift pressure = 425.03 lbs.  
 G= 0.42  
 CD= 1.6  
 CM= 1  
 Ct= 0.8

Worst Case Uplift: SCE  
 425.03 lbs.

\*2012 NDS: Table 11.3.2A

Ceg= 1  
 Ctn= 1

Wood Type: Spruce-Pine-Fir  
 Anchor Type: 5/16 in. Lag Screw

Min. Thread Length: 1.50 in.  
 Min. Screw Length: 3.25 in.

Allowable Shear: 448 lbs. Shear OK  
 Allowable Uplift: 506.036 lbs. Uplift OK

Allowable Shear and Uplift values from 2005 NDS Ch. 10 and 11 using the ASD method

<b>ANCHORS STRUCTURALLY ACCEPTABLE</b>			
USE	<u>5/16 in. Lag Screw</u>	ANCHORS	
WITH A SPACING	OF <u>4.00</u> FT. O.C.	TYP.	AND
	AN EMBEDMENT OF <u>1.5</u>	in.	



## Solar Array Structural Summary

This report describes the structural load contribution of the solar array installed at the address below. If the solar array is to be installed in more than one plane, then the *Panel Grouping* determined to contribute the most concentrated load is selected for use in the calculations. A separate calculation for each *Panel Grouping* can be provided upon request.

Notes: Specified anchor works in all roof zones. Zone 3 is our worst case wind loading on the solar arrays.

Panel Grouping Identification # **5332 EAST SOLANO DRIVE, PARADISE VALLEY, AZ 85253**

### Site Description

Installation Site Address : **Fill in Address**  
 Building Type : Original Dwelling  
 Mounting Surface : Pitched High Profile Tile  
 Drainage System : By Slope  
 Roof Slope : 0°  
 Framing Type : Manufactured Trusses  
 Framing Spacing : 24 in.

### System Equipment Description

Solar Modules : Hyundai HiS-S280RG-(BK) (41.2 lbs; 64.57 inches by 39.29 inches)  
 Vertical Support System : Solar Wedge, 15 degree  
 Horizontal Support System : ProSolar Rail, 2.5" deep

### Panel Grouping Description

Mounting Style : Portrait  
 Panel Tilt : 0°  
 No. of Modules in Panel Grouping : 10  
 Total Weight of Array Grouping : 492 lbs.  
 Panel Grouping Area : 176 sq. ft.  
 No. of Vertical Supports : 18  
 Spacing Between Supports : 4 ft.  
 No. of Framing Members Below : 16

} Values are based on the maximum allowable spacing. See notes at top of sheet if attachments are different in another roof zone.

### Structural Loading

Building Code : 2012 IRC  
 Maximum Point Load : 30.1 lbs. - Value based on maximum tributary area  
 Average Point Load : 27.3 lbs. - Value based on total weight of array per # of vertical supports  
 Distributed Load : 2.8 psf  
 Maximum Wind Load for Uplift : 41.2 psf  
 Wind Shear : 39.7 lbs.  
 Wind Uplift : 425 lbs.

} Values are the individual reactions at each vertical support attachment (i.e. required anchor strength).

### Attachment Description

Wood Type : Spruce-Pine-Fir  
 Anchor Type : 5/16 in. Lag Screw  
 Min. Thread Length: : 1.5 in.  
 Min. Screw Length: : 3.25 in.



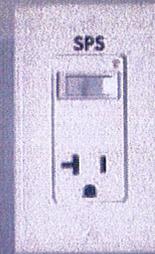
# SUNNY BOY 3.0-US / 3.8-US / 5.0-US / 6.0-US / 7.0-US / 7.7-US



SBE3.0-1SP-US-40 / SB3.8-1SP-US-40 / SB5.0-1SP-US-40  
SB6.0-1SP-US-40 / SB7.0-1SP-US-40 / SB7.7-1SP-US-40



**WORLD'S FIRST  
SECURE POWER SUPPLY**



OUTLET NOT INCLUDED

### Value-Added Improvements

- World's first Secure Power Supply now offers up to 2,000 W
- Full grid management capabilities ensures a utility-compliant solution for any market

### Reduced Labor

- New Installation Assistant with direct access via smartphone minimizes time in the field
- Integrated disconnect simplifies equipment stocking and speeds installation

### Unmatched Flexibility

- SMA's proprietary OptiTrac™ Global Peak technology mitigates shade with ease
- Multiple independent MPPTs accommodate hundreds of stringing possibilities

### Trouble-Free Servicing

- Two-part enclosure concept allows for simple, expedited servicing
- Enhanced AFCI technology reduces false tripping while improving sensitivity in real arcs, greatly reducing unneeded service calls

## SUNNY BOY 3.0-US / 3.8-US / 5.0-US / 6.0-US / 7.0-US / 7.7-US

Reduce costs across your entire residential business model

The residential PV market is changing rapidly, and we understand that your bottom line matters more than ever. That's why we've designed a superior residential solution that will help you decrease costs throughout all stages of your business operations. The Sunny Boy 3.0-US/3.8-US/5.0-US/6.0-US/7.0-US/7.7-US join the SMA lineup of field-proven solar technology backed by the world's #1 service team, along with a wealth of improvements. Simple design, improved stocking and ordering, value driven sales support and streamlined installation are just some of the ways that SMA is working to help your business operate more efficiently.

**Technical data**

	Sunny Boy 3.0-US *		Sunny Boy 3.8-US *		Sunny Boy 5.0-US	
	208 V	240 V	208 V	240 V	208 V	240 V
<b>Input (DC)</b>						
Max. usable DC power	3100 W	3100 W	3450 W	3900 W	5250 W	5250 W
Max. DC voltage				600 V		
Rated MPP voltage range	155 - 480 V		195 - 480 V		220 - 480 V	
MPPT operating voltage range			100 - 550 V			
Min. DC voltage / start voltage			100 V / 125 V			
Max. operating input current per MPPT			10 A			
Max. short circuit current per MPPT			18 A			
Number of MPPT tracker / string per MPPT tracker			2/1		3 / 1	
<b>Output (AC)</b>						
AC nominal power	3000 W	3000 W	3330 W	3800 W	5000 W	5000 W
Max. AC apparent power	3000 VA	3000 VA	3330 VA	3800 VA	5000 VA	5000 VA
Nominal voltage / adjustable	208 V / ●	240 V / ●	208 V / ●	240 V / ●	208 V / ●	240 V / ●
AC voltage range	183 - 229 V	211 - 264 V	183 - 229 V	211 - 264 V	183 - 229 V	211 - 264 V
AC grid frequency			60 Hz / 50 Hz			
Max. output current	14.5 A	12.5 A	16.0 A	16.0 A	24.0 A	24.0 A
Power factor (cos φ)			1			
Output phases / line connections			1 / 2			
Harmonics			< 4 %			
<b>Efficiency</b>						
Max. efficiency	97.2 % *	97.5 % *	97.2 % *	97.5 % *	97.2 %	97.5 %
CEC efficiency	96.5 % *	97.0 % *	96.5 % *	97.0 % *	96.5 %	97 %
<b>Protection devices</b>						
DC disconnect device			●			
DC reverse polarity protection			●			
Ground fault monitoring / Grid monitoring			●			
AC short circuit protection			●			
All-pole sensitive residual current monitoring unit (RCMU)			●			
Arc fault circuit interrupter (AFCI)			●			
Protection class / overvoltage category			I / IV			

**General data**

Dimensions (W / H / D) in mm (in)	535 x 730 x 198 (21.1 x 28.5 x 7.8)
Packaging Dimensions (W / H / D) in mm (in)	600 x 800 x 300 (23.6 x 31.5 x 11.8)
Weight	26 kg (57 lb)
Packaging weight	30 kg (66 lb)
Operating temperature range	- 25 °C ... +60 °C
Noise emission (typical)	< 25 dB(A)
Internal power consumption at night	< 5 W
Topology	Transformerless
Cooling concept	Convection

**Features**

Secure Power Supply	●
Display (2 x 16 characters)	●
Interfaces: Ethernet / WLAN	● / ●
Sensor module / External WLAN antenna	○ / ○
Warranty: 10 / 15 / 20 years	● / ○ / ○

**Certificates and approvals**

UL 1741, UL 1998, UL 1699B, IEEE1547, FCC Part 15 (Class A & B), CAN/CSA V22.2 107.1-1  
 ● Standard features ○ Optional features – Not available Data at nominal conditions NOTE: US inverters ship with gray lids. \* Preliminary data, UL pending

**Type designation**

SB3.0-1SP-US-40 SB3.8-1SP-US-40 SB5.0-1SP-US-40

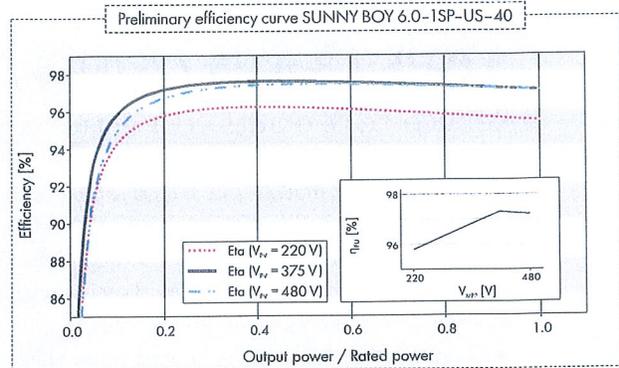
**Accessories**



Sensor module  
MD.SEN-US-40



External WLAN antenna  
EXTANT-US-40



Technical data	Sunny Boy 6.0-US		Sunny Boy 7.0-US *		Sunny Boy 7.7-US *	
	208 V	240 V	208 V	240 V	208 V	240 V
<b>Input (DC)</b>						
Max usable DC power	5500 W	6300 W	6900 W	7350 W	6950 W	8100 W
Max. DC Voltage				600 V		
Rated MPP Voltage range	220 - 480 V		245 - 480 V		270 - 480 V	
MPPT operating voltage range			100 - 550 V			
Min. DC voltage / start voltage			100 V / 125 V			
Max. operating input current per MPPT			10 A			
Max. short circuit current per MPPT			18 A			
Number of MPPT tracker / string per MPPT tracker			3 / 1			
<b>Output (AC)</b>						
AC nominal power	5200 W	6000 W	6660 W	7000 W	6660 W	7680 W
Max. AC apparent power	5200 VA	6000 VA	6660 VA	7000 VA	6660 VA	7680 VA
Nominal voltage / adjustable	208 V / ●	240 V / ●	208 V / ●	240 V / ●	208 V / ●	240 V / ●
AC voltage range	183 - 229 V	211 - 264 V	183 - 229 V	211 - 264 V	183 - 229 V	211 - 264 V
AC grid frequency			60 Hz / 50 Hz			
Max. output current	25.0 A	25.0 A	32.0 A	29.2 A	32.0 A	32.0 A
Power factor (cos φ)			1			
Output phases / line connections			1 / 2			
Harmonics			< 4 %			
<b>Efficiency</b>						
Max. efficiency	97.2 %	97.6 %	97.1 % *	97.2 % *	97.1 % *	97.2 % *
CEC efficiency	96.5 %	97 %	96.5 % *	96.5 % *	96.5 % *	96.5 % *
<b>Protection devices</b>						
DC disconnect device			●			
DC reverse polarity protection			●			
Ground fault monitoring / Grid monitoring			●			
AC short circuit protection			●			
All-pole sensitive residual current monitoring unit (RCMU)			●			
Arc fault circuit interrupter (AFCI)			●			
Protection class / overvoltage category			I / IV			
<b>General data</b>						
Dimensions (W / H / D) in mm (in)			535 x 730 x 198 (21.1 x 28.5 x 7.8)			
Packaging Dimensions (W / H / D) in mm (in)			600 x 800 x 300 (23.6 x 31.5 x 11.8)			
Weight			26 kg (57 lb)			
Packaging weight			30 kg (66 lb)			
Operating temperature range			- 25°C ...+60°C			
Noise emission (typical)	26 dB(A)				30 dB(A) *	
Internal power consumption at night			< 5 W			
Topology			Transformerless			
Cooling concept	Convection				Fan	
<b>Features</b>						
Secure Power Supply			●			
Display (2 x 16 characters)			●			
Interfaces: Ethernet / WLAN			● / ●			
Sensor module / External WLAN antenna			○ / ○			
Warranty: 10 / 15 / 20 years			● / ○ / ○			
Certificates and approvals			UL 1741, UL 1998, UL 1699B, IEEE1547, FCC Part 15 (Class A & B), CAN/CSA V22.2 107.1-1			
● Standard features ○ Optional features – Not available			Data at nominal conditions NOTE: US inverters ship with gray lids. * Preliminary data, UL pending			
Type designation			SB6.0-1SP-US-40		SB7.0-1SP-US-40	

## SAME NAME, NEW GAME

The Sunny Boy 3.0-US through 7.7-US are once again raising the bar by offering improved performance, enhanced features, and most importantly, an economical approach to residential solar. Your business model is a value chain. The new Sunny Boy-US series can help you stay competitive in an increasingly price sensitive residential market by driving down costs across all of your business operations.





## RAPID SHUTDOWN SYSTEM

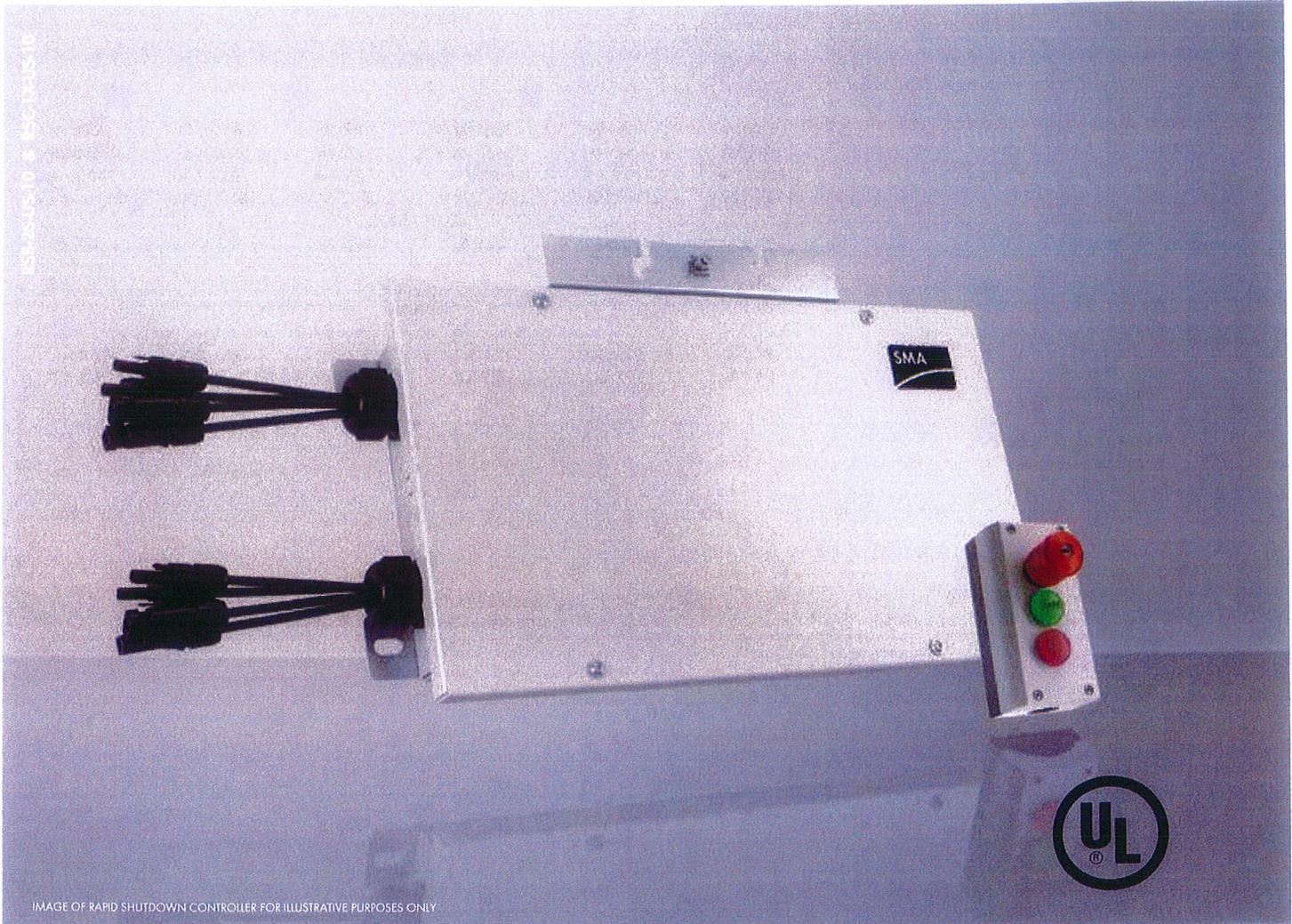


IMAGE OF RAPID SHUTDOWN CONTROLLER FOR ILLUSTRATIVE PURPOSES ONLY

### Reliable

- Optimal system reliability with hybrid switches for disconnecting
- Automatic self-test upon startup to ensure functionality

### Perfect alignment

- Engineered for Sunny Boy-US and Sunny Boy TL-US inverter lines with multiple MPP tracking channels
- Compatible with Secure Power Supply

### Code compliant

- UL-Certified and compliant with 2014 NEC 690.12 Rapid Shutdown
- No interference with AFCI function of Sunny Boy inverters

### Cost effective

- Incorporated junction box reduces equipment and speeds installation time
- Pre-wired MC4 connectors and snap terminals reduce materials and installation time

## RAPID SHUTDOWN SYSTEM

### Cost-effective system compliance

The SMA Rapid Shutdown System is the most cost-effective way to achieve 2014 NEC 690.12 Rapid Shutdown compliance for systems using Sunny Boy inverters. This DC powered system allows for the use of Secure Power Supply, providing opportunity power to homeowners during daytime grid outages. Hybrid switches and automatic self-test ensure system safety and durability, reducing risk and costs. Each component plays a critical role in a PV system; don't compromise your Sunny Boy's performance with any other rapid shutdown solution.





### SIMPLE, FLEXIBLE DESIGN

Speed the completion of customer proposals and maximize the efficiency of your design team with the Sunny Boy-US series, which provides a new level of flexibility in system design by offering:

- » Hundreds of stringing configurations and multiple independent MPPTs
- » SMA's proprietary OptiTrac™ Global Peak shade mitigation technology
- » Diverse application options including on- and off-grid compatibility



### VALUE-DRIVEN SALES ENABLEMENT

SMA wants to enable your sales team by arming them with an abundance of feature/benefit support. Show your customers the value of the Sunny Boy-US series by utilizing:

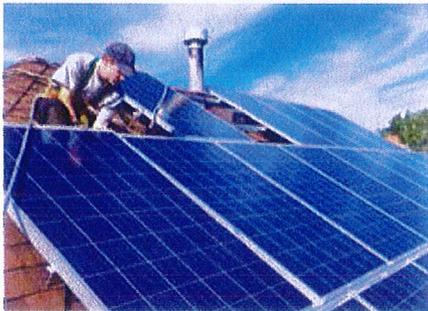
- » Secure Power Supply, now with 2,000 W of opportunity power in the event of a grid outage, as an increased value-add or upsell opportunity
- » SMA's 35 year history and status as the #1 global inverter manufacturer instills homeowners with peace of mind and the long-term security they demand from a PV investment
- » An economical solution for shade mitigation and the challenges of complex roofs



### IMPROVED STOCKING AND ORDERING

Ensure that your back office business operations run smoothly and succinctly while mitigating potential errors. The Sunny Boy-US series can help achieve cost savings in these areas by providing:

- » An integrated DC disconnect that simplifies equipment stocking and allows for a single inverter part number
- » All communications integrated into the inverter, eliminating the need to order additional equipment



### STREAMLINED INSTALLATION AND COMMISSIONING

Expedite your operations in the field by taking advantage of the new Sunny Boy's installer-friendly feature set including:

- » Direct access via smartphone and utilization of SMA's Installation Assistant, which minimizes time/labor spent in the field and speeds the path to commissioning
- » Improved communication—no need to install additional equipment
- » Integrated DC disconnect that simplifies onsite logistics and eliminates the need to install a separate disconnect unit, speeding overall installation time



### SUPERIOR SERVICE

SMA understands the factors that contribute to lifetime PV ownership cost, that's why the Sunny Boy-US series was designed for maximum reliability and backstopped by an unmatched service offering. Benefit from:

- » The new Sunny Boy's two-part enclosure concept that separates the connection unit from the power unit, which allows for simple, expedited servicing
- » The #1 service team in the PV industry, as recognized by IMS research, with experience servicing an installed base of more than 40 GW

# SolarWedge™

Load Tested  
**110mph**  
 Wind Load  
**30 lbs. sq**  
 At 6' On Cen.

## Revolutionary Commercial Mounting System!

SolarWedge® by Professional Solar Products, Inc. is an innovative low profile commercial/residential PV mounting system. The system provides an easy to install and economical solution for 5, 10 or 15 degree structural attachment. SolarWedge® integrates with Professional Solar's patented "top-down" commercial RoofTrac® and FoamJack® stanchion products. The system dramatically lowers installation and shipping costs while optimizing installed wattage on the roof.

### Advantages of the SolarWedge®

- \* Easy handling and Installation: Each box supports up to 30' (front & rear) of RoofTrac® support rails
- \* Integrated Leveling System: Compensates up to 2-1/2" of roof variation using an included 1/2" x 4" stainless steel stud
- \* Fully Engineered: Load tested to 30 lbs. per sq. ft (approx. 110 mph wind load) at up to 6' centers
- \* Finished Aluminum Parts: Clear anodized angled support brackets match support rail. FoamJack® stanchion parts are machine tumbled and cleaned to provide excellent bonding of foam, flash or seal



#### SolarWedge®

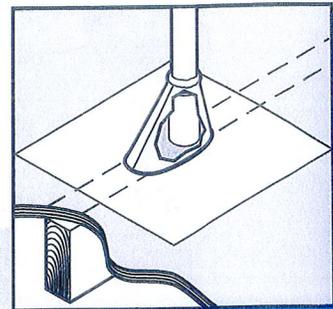
Precision extruded angles of anodized aluminum compress the support rail at a fixed angle while dramatically increasing the strength

#### Leveling Feature

Stud rolls into the post up to 2-1/2" to eliminate the need for cutting studs on the job

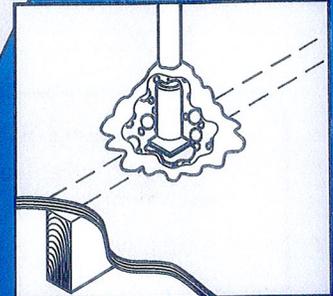
#### FoamJack®

Each kit includes the FoamJack® with a 3" aluminum seal plate. Size included depends on the angle purchased



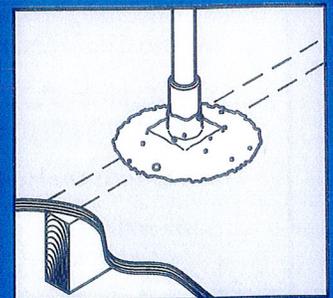
#### Flash

The FoamJack® easily accommodates roof flashing required



#### Foam

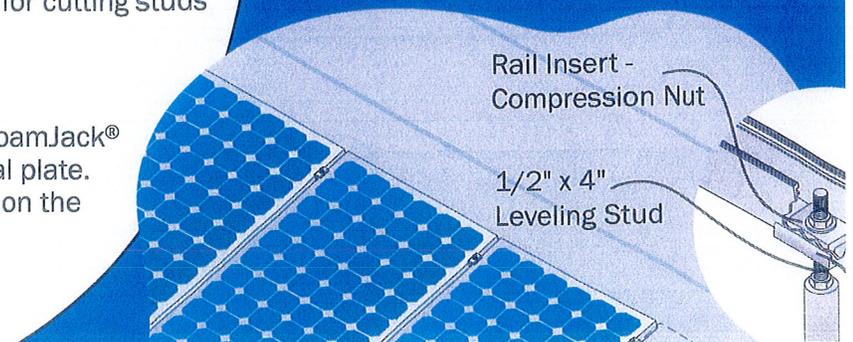
Using a 2-part held or true foaming system, a "flashing" density roof



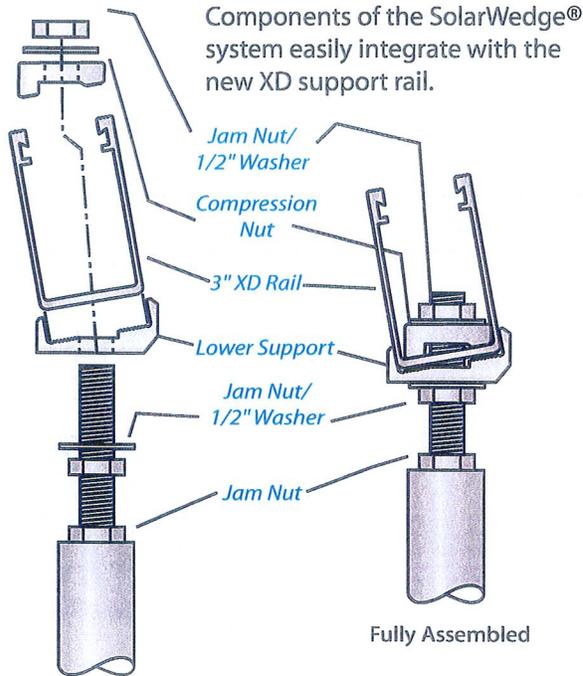
#### Seal

Using a UV roof sealant seal plate, very economical method that takes seconds to time and in costs!

*\*Before determining best sealing method, check with your department for any local requirements*

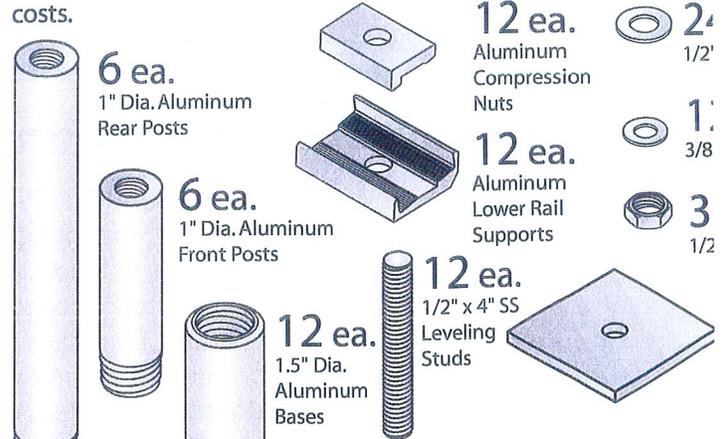


## Assembly of the SolarWedge®



## Attachment Parts List (Per Box)

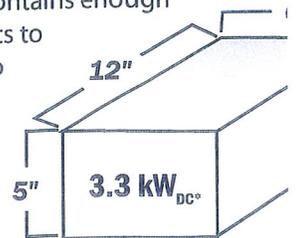
Shipped in a shoe box sized package, the SolarWedge XD components offer easy handling and storage along with reduced costs.



Specifications are subject to change without notice.

## Attachment Box Dimensions

Each box contains enough attachments to install up to 3.3 kW<sub>DC</sub>



10 Degree Box Dimensions Illustrated

## Standard SolarWedge® Technical Information

> Load Tested and engineered to 30 lbs. per ft<sup>2</sup> (approx. 110mph wind load equivalent)

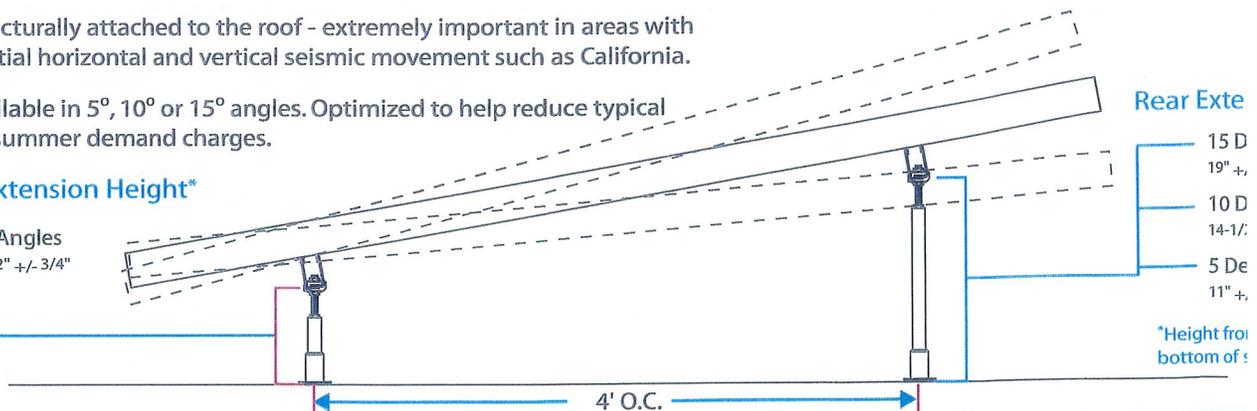
> Utilizes FoamJack® Laboratory tested to 2,870 lbs. vertical and 2,615 lbs. side lateral pull out using a 3/8" x 6" lag bolt (secured at approx. 6-1/2").

> Structurally attached to the roof - extremely important in areas with potential horizontal and vertical seismic movement such as California.

> Available in 5°, 10° or 15° angles. Optimized to help reduce typical peak summer demand charges.

### Front Extension Height\*

All Angles  
6-1/2" +/- 3/4"

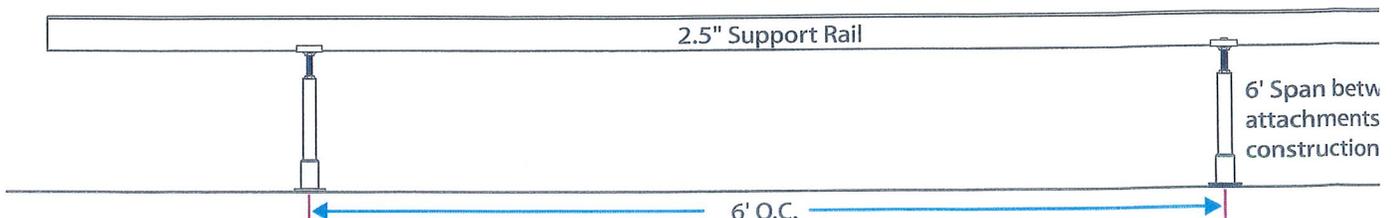


Rear Extension

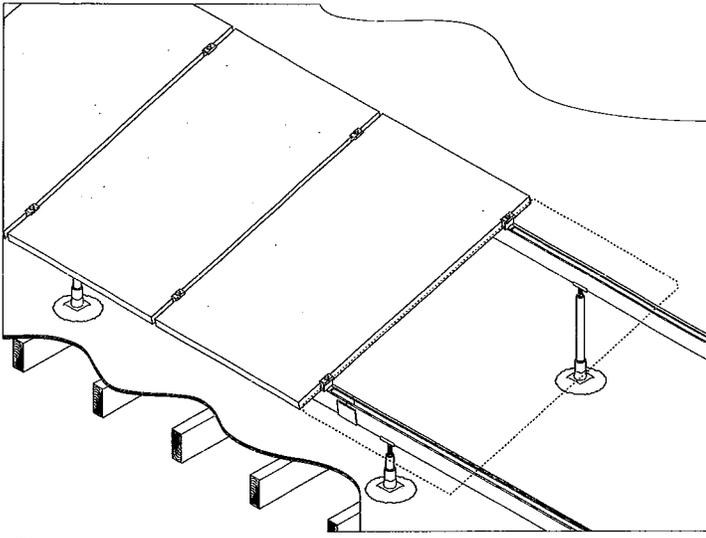
15 D  
19" +  
10 D  
14-1/2"  
5 D  
11" +

\*Height from bottom of s

## Rear View



Drill Guide (Sold



### APPLICATION:

The SolarWedge<sup>®</sup> product line provides an easy-to-install and economical solution for a 5, 10 or 15 degree tilted roof mounted system. SolarWedge<sup>®</sup> integrates with Professional Solar's (ProSolar) patented "top-down" clamps and deep channel support rails. The system dramatically lowers installation and shipping costs while optimizing installed wattage on the roof.



### WARNING

All ProSolar are engineered and tested to withstand stated specifications (as stated on published specification sheets) when installed properly. Failure to install properly may decrease the performance of the installation.



### SAFETY

All regional safety requirements should be followed when installing ProSolar Products. All tools and equipment located on the roof should be secured to avoid falling object hazards. All equipment/tools should be properly maintained and inspected prior to use. Any exposed studs should be protectively capped to help avoid injury. This installation manual is intended for use by professional installers with a working knowledge of construction principles.

### Symbol Legend



Explanation or Install Tip



Important Product Performance Information



Critical for Safety

### Tool List

- Cordless drill with 1/4" diameter, long drill bit
- Cordless drill with 3/8" carbide (masonry) bit
- Cordless impact wrench (with appropriate lag bolt socket)
- 3/4" (18mm) titanium plated self starting #3 Unibit<sup>®</sup>
- 1/2" self starting #10 Unibit<sup>®</sup>
- 3/4" open-end wrench
- Adjustable pliers
- 9/16" Deep socket
- 1/2" box-end wrench
- Tape measure
- String line (chalk line)
- Lumber crayon
- Sharpie<sup>®</sup> pen
- Stiff paint brush
- FoamJack<sup>®</sup> drill guide
- Dead-blow hammer (approx. 21 oz)
- Precision stud sensor (recommended Zircon<sup>®</sup> I520)

## Installation steps overview

- 1) System layout & chalk line marking
- 2) Locating roof rafters along chalk lines
- 3) Attaching/sealing SolarWedge®
- 4) Installing XD Splice
- 5) Fastening rail to SolarWedge® attachment
- 6) Installation of the clamping hardware/modules
- 7) Clean up/Quality Inspection

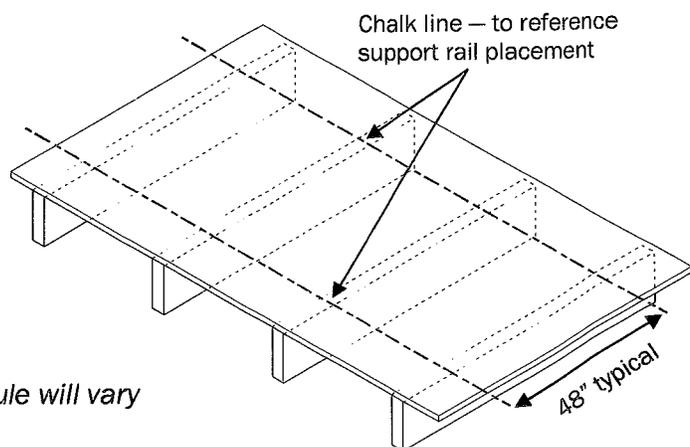
## Step 1: System layout & chalk line marking

Prior to beginning attachment work, the system roof layout should be defined.

A drawing or sketch, prior to roof work, is recommended.

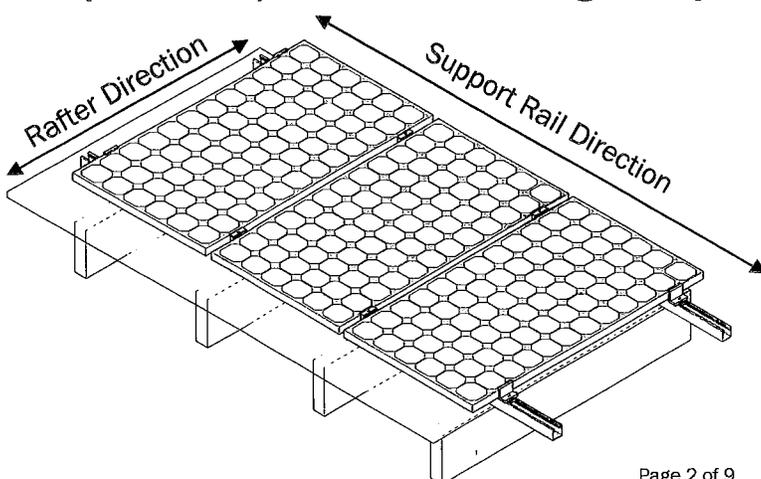
Upon finalizing layout, use chalk lines to mark support rail locations. The chalk lines will be used to align SolarWedge® attachment points.

*Note: The rail distance from the end of the module will vary based on module size.*



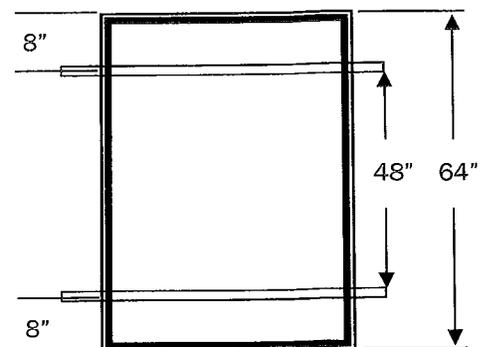
ProSolar does not recommend 72" attachment spacing on residential structures, as residential structures are typically not designed for longer spans. It is highly recommended to obtain proper structural engineering for loading of the structure before specifying a long-span mounting system.

### Proper module/rail orientation—single array sample



Clamps must secure the module on the *long end* of the frame. The span of the two support rails should be 48".

**EXAMPLE:** (Using a 64" long module)



## Step 2: Locating structural members along chalk lines

### Finding initial reference support member for a commercial flat roof:

- 1) Locating commercial roof landmarks is usually sufficient for finding the initial reference support member. Landmarks include skylights, vents and air conditioning units, as these are normally beside known structural members.
- 2) Upon identifying the general location of the support member, use a precision stud sensor to locate the center of the support member.



Depending on the thickness of the roofing material the Zircon® stud sensor may accurately indicate the location of the support member which significantly reduces location time.

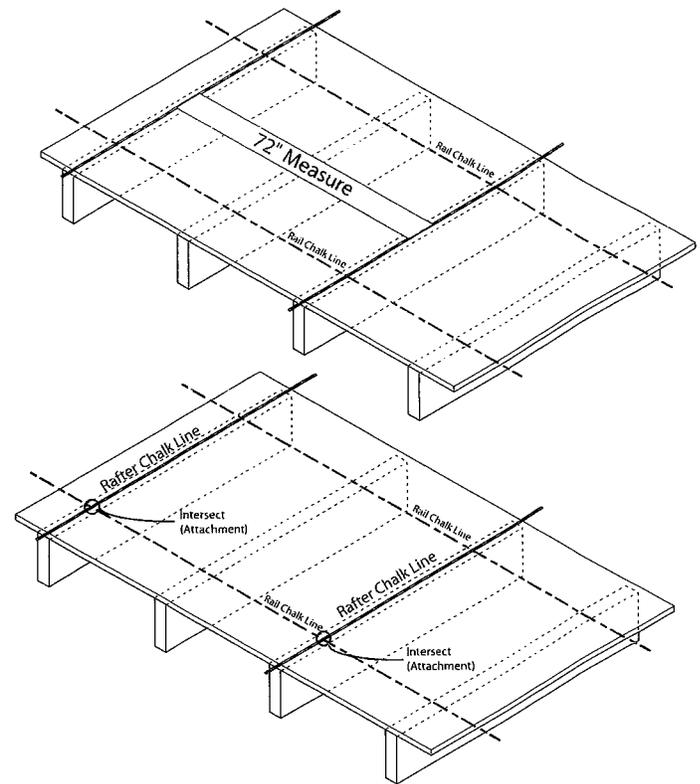


In some structures, such as open warehouses, the landmarks and structural members are visible from below, which helps make locating structural members from the roof easier.



#### Alternate method of finding structural members (STEP 3):

Using a **dead blow hammer**, lightly tap perpendicular to the approximate structural member location until a solid sound is heard. The dead blow hammer impact directly above the structural member will emit a deeper sound.



- 3) Once the initial reference support member center location is identified, measure the appropriate distance (72") to help approximate the next support member/connection location.

## Step 3: Attaching / Sealing SolarWedge®

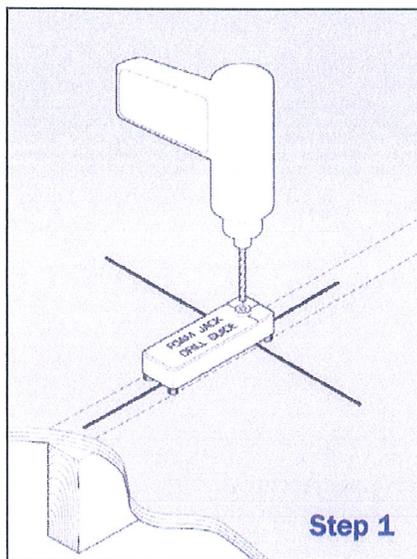


Mark (with lumber crayon) or account for ALL holes, including small nail holes, to ensure roof is properly sealed. Approximate attaching/sealing time: 5 min. per attachment.



There are many sealant methods, including, but not limited to, polyurethane sealing, flashing and foaming. The SolarWedge® is compatible with readily available, standard 1" diameter metal flashings (approx. 4-1/2" minimum flashing height). If foaming, post threads should be protected to avoid foam intrusion.

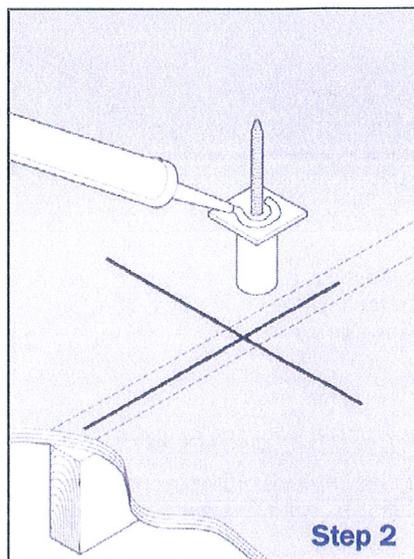
*Polyurethane sealant method illustrated in this installation sequence.*



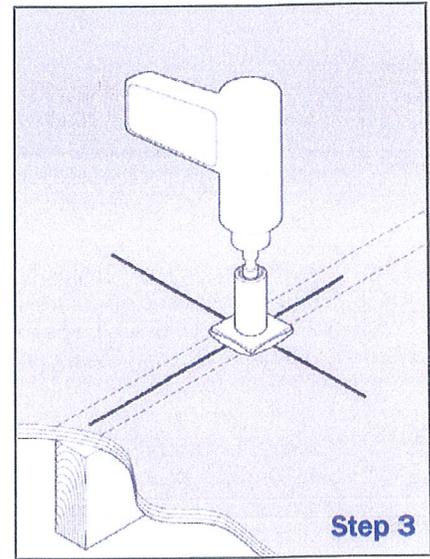
For 3/8" x 6" lag bolt applications

**STEP 1a:** Using a 3/8" carbide (masonry) bit, break through the cap sheet.

**STEP 1b:** Using the FoamJack® drill guide and a 1/4" dia. long drill bit, drill a hole in the center of the joist.



**STEP 2:** Apply a generous amount of polyurethane sealant (Sikaflex™ 1A or equivalent recommended) to the bottom of the seal plate of the SolarWedge® creating a circle around the lag bolt hole.



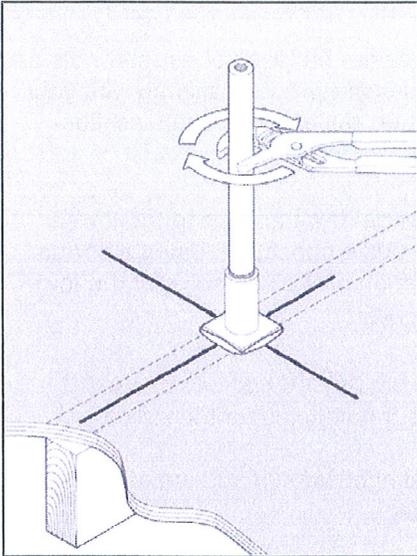
**STEP 3:** Using a cordless impact wrench and a 9/16" deep socket, install the bolt into the SolarWedge® base until seated. Allow the sealant to flow outward around the edges of the seal plate.



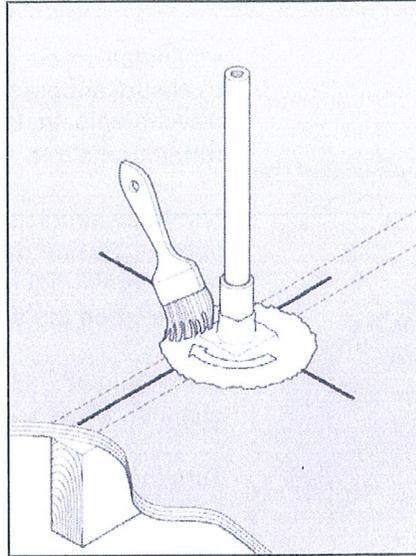
Using a carbide bit to break through the cap sheet will avoid premature dulling of the wood drill bit. Use two drills, one with a 3/8" carbide bit, one with a 1/4" long wood drill bit to save time.



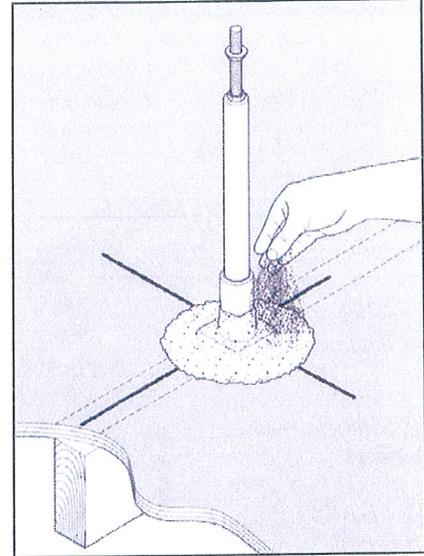
Lag bolts are not included with the SolarWedge® products due to site (job) specific requirement variation. The installation manual references the use of 3/8" x 6" lag bolts. Consult your structural engineer for site (job) specific fastener requirements.



**STEP 4:** Install the post using an adjustable wrench. Turn wrench clockwise until fully secured. Avoid twisting the base while tightening.



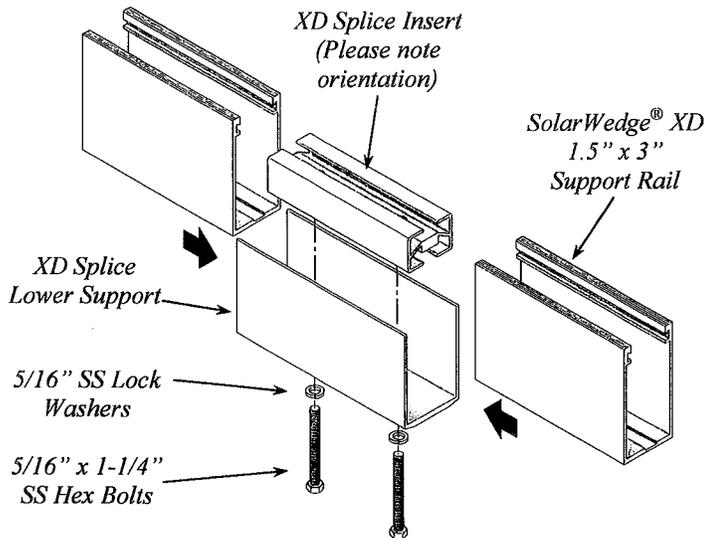
**STEP 5:** Seal the top of the seal plate with a layer of Sikaflex<sup>®</sup> using a stiff paintbrush. Cover the entire base plate with the sealant, at least half the post and about 1-1/2" around the plate.



**STEP 6:** Using Play/Silica sand, cover the sealant. *This step prevents debris from sticking to the sealant while drying and gives it a clean, finished appearance.*  
**IMPORTANT:** Do not install leveling kit hardware until support rail installation.

## Step 4: Installing XD Splice

*Install XD Splice prior to installing support rails*



Pre-install splice kits for easier handling of support rails and to ensure support rail holes are properly aligned with your attachments. Install support rail and splice kits as illustrated to the left.

Turn the support rails upside-down and place the lower splice extrusion over the desired location. Using a permanent marker, dot the location of the bolt holes of the lower extrusion on the support rail.

Using a Unibit® #10 Drill bit, drill through each support channel. These will be your bolt holes for the splice.

Turn the support channel right-side up and install the splice kit as illustrated to the left.



### Unibit® Drill Bit

Compensates for approx. 1/4" drilled hole spacing inaccuracy  
Short bit length prevents drilling through surface below support rail  
Bit design prevents drill from twisting as commonly experienced with standard drill bits.

Unibit® 1/2" #10 - Used for Splice Kit

Unibit® 3/4" #3—Used for support rail/leveling hardware integration

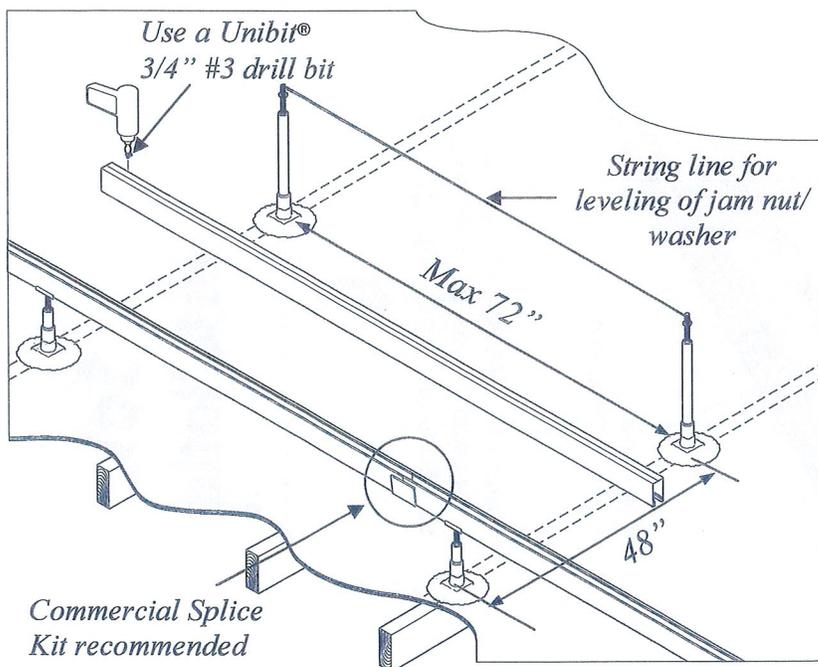


Leave 1-1/4" hex bolts fastened when installed within 2" of an inter-module clamp.



Maximum of four rails can be spliced to allow for thermal expansion

## Step 5: Fastening rail to SolarWedge® attachment



**STEP 1:** Using a string line from each end of the module array, level studs to desired position on roof (4" leveling stud must have at least 1" threaded into post).

**STEP 2:** Measure and mark hole placement on support rails by placing support rail upside down over studs—use a Sharpie® permanent marker to mark where drill holes should be placed. (Refer to RoofTrac® installation manual for more details).

**STEP 3:** Using the titanium plated 3/4" #3 self-starting Unibit® (sold separately) drill holes at stud centers along support rail.



Use a Unibit® 3/4" #3 titanium drill bit for drilling the support rail reduces drill time to a mere 3 seconds.



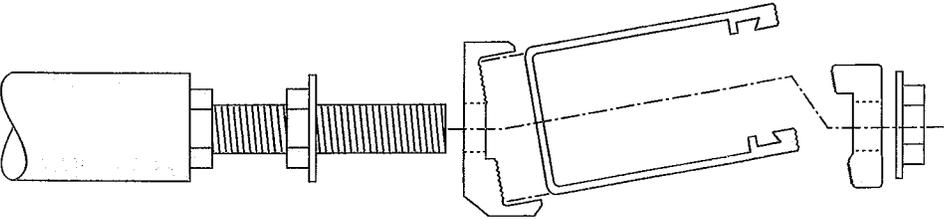
**STEP 4:** Install support rail using the SolarWedge® components as illustrated below.

# SolarWedge<sup>®</sup> Installation Manual

Date Modified: 9/17/07

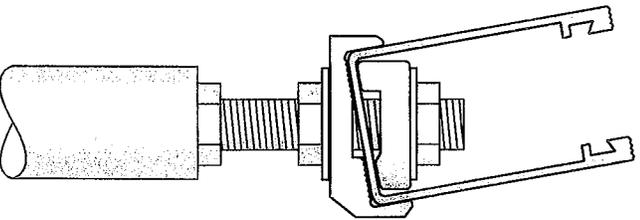
**A**

Level support rail



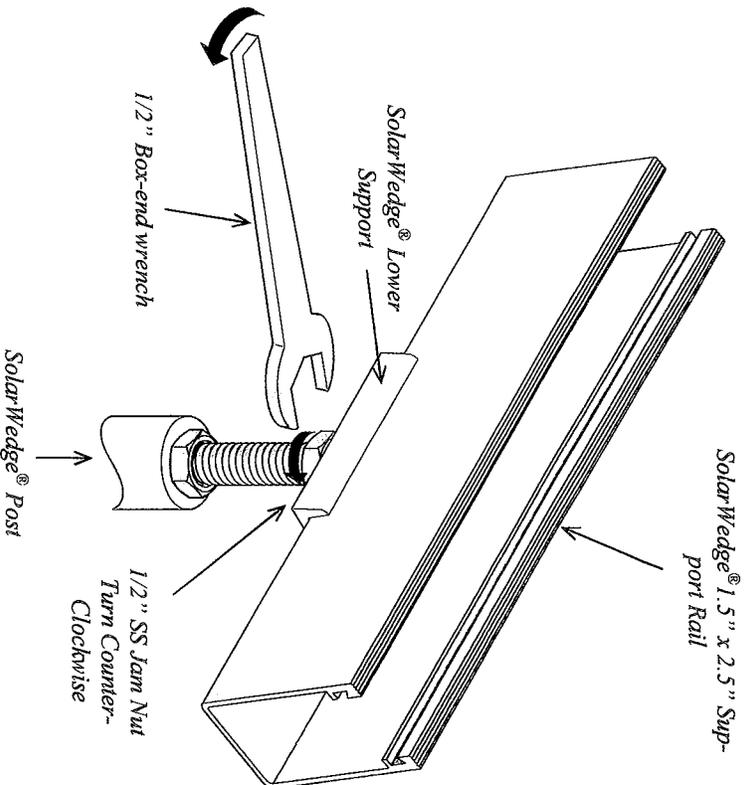
**B**

Hand-tighten 1/2" Jam Nut/washer



**C**

Using a 1/2" Box End wrench, tighten the lower jam nut turning counter-clockwise. Repeat for all attachment

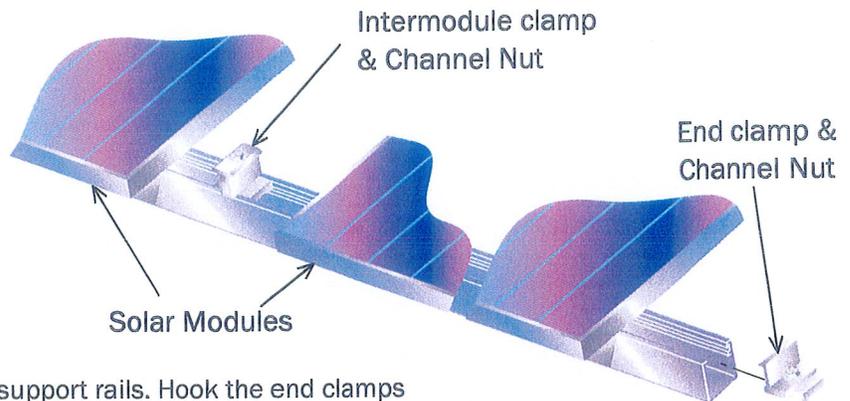


## Step 6: Installation of the clamping hardware/modules

There are two sets of clamps; the outside clamps (end clamps) and the inter-module clamps that install between the modules.



It is recommended to pre-thread or start the bolt, lock washer and clamp into the channel nut prior to bringing them to the roof. This will reduce roof work time.



Insert an end clamp at the end of each row of support rails. Hook the end clamps against the long end of the module and square off to the support rail. Tighten the clamps using a 1/2" box wrench or drive socket. **DO NOT OVER-TIGHTEN**, we recommend a maximum torque of 12 ft. lbs. to prevent damage to the module glass.

After the first module is secured, slide two inter-module clamp sets onto the first module. They are designed to remain captive in the channel allowing the installer to slide and align the next module. Repeat this procedure until all modules are installed onto the support rails. Upon installation of the last module, install the module end clamps to complete the installation.



Hands-free clamp design allows both hands to be used to position modules while clamps remain captive in the support rail.

## Step 7: Clean up / Quality Inspection

### Clean Up:

Upon completing the attachment installation, account for all tools and clean area as necessary.

### Quality Inspection:

It is recommended that each contractor perform a final attachment quality inspection prior to installing the RoofTrac® mounting system to ensure all attachments are properly fastened.



Make sure all installation crew members on the roof are mindful of installed roof attachments to prevent tripping. All installation crew members should utilize proper safety equipment when installing a solar system. (Harnesses, hard hats, gloves, proper no-slip footwear, etc.)

