

HISTORIC AND DESIGN REVIEW COMMISSION

May 03, 2017

HDRC CASE NO: 2017-193
ADDRESS: 1810 E PYRON AVE
LEGAL DESCRIPTION: NCB 7650 BLK LOT NE TRI 33.13 FT OF K & W IRR 90 FT OF L
ZONING: R-6, RIO-5, H
CITY COUNCIL DIST.: 3
DISTRICT: Mission Historic District
APPLICANT: Advanced Solar
OWNER: Ronald Bechtol
TYPE OF WORK: New Solar Installation
REQUEST:

The applicant is requesting a Certificate of Appropriateness for approval to:

1. Locate three solar panels on the interior east facing roof slope.
2. Locate five solar panels on the south (rear) facing roof slope.
3. Locate ten solar panels on the exterior east facing roof slope.

APPLICABLE CITATIONS:

Historic Design Guidelines, Chapter 3, Guidelines for Additions

6. Designing for Energy Efficiency

C. SOLAR COLLECTORS

- i. Location*—Locate solar collectors on side or rear roof pitch of the primary historic structure to the maximum extent feasible to minimize visibility from the public right-of-way while maximizing solar access. Alternatively, locate solar collectors on a garage or outbuilding or consider a ground-mount system where solar access to the primary structure is limited.
- ii. Mounting (sloped roof surfaces)*—Mount solar collectors flush with the surface of a sloped roof. Select collectors that are similar in color to the roof surface to reduce visibility.
- iii. Mounting (flat roof surfaces)*—Mount solar collectors flush with the surface of a flat roof to the maximum extent feasible. Where solar access limitations preclude a flush mount, locate panels towards the rear of the roof where visibility from the public right-of-way will be minimized.

FINDINGS:

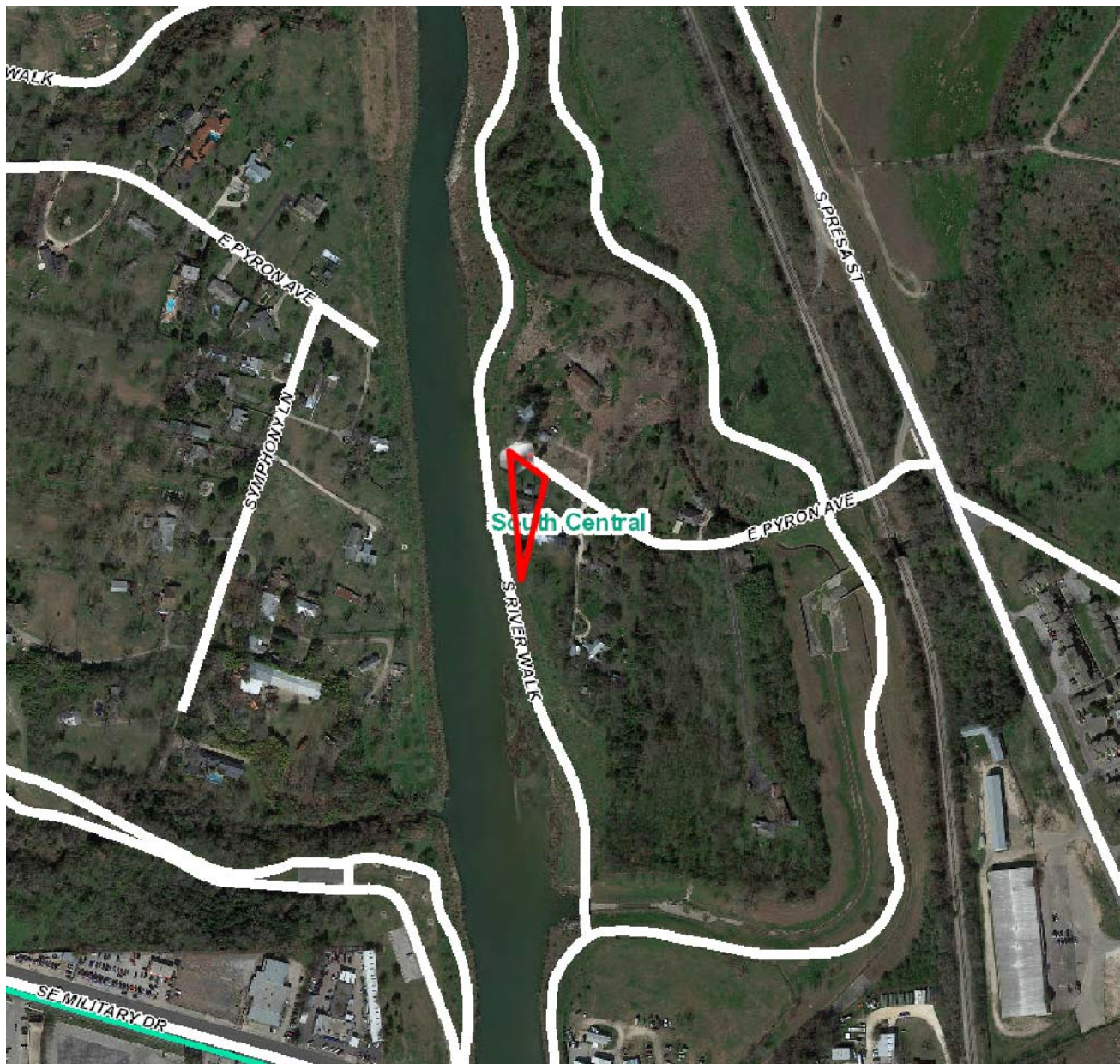
- a. The structure located at 1810 E Pyron Avenue was constructed circa 1955 and is located within the Mission Historic District, adjacent to the San Antonio River and the Mission Reach of the San Antonio River Walk. The structure features two wings which creates a rear courtyard. The applicant has proposed to install solar panels on the east facing roof slopes of the two rear wings and on the rear (south) facing roof slope of the front massing of the house.
- b. The Guidelines for Additions 6.C.i. states that solar collectors should be located on the side or rear roof pitch of the primary historic structure to the maximum extent feasible to minimize visibility from the public right of way while maximizing solar access. The applicant has proposed to locate the proposed panels on the east facing roof slopes and the south facing roof slopes, each of the slopes are located on the side and rear of the structure. The panels located on the east roof slope would be visible from the right of way at E Pyron while the panels located on the rear (south) roof slope would be visible from the Mission Reach of the San Antonio River Walk. Staff finds that the applicant has located the proposed panels to be consistent with the Guidelines. Additionally, staff finds that given the setbacks of the structure, the house orientation and the non-typical orientation and setbacks of neighboring structures, the proposed panels will not jeopardize the historic integrity of this portion of E Pyron. This installation would not be appropriate if located within a dense, historic district where house orientations and setbacks are consistent with San Antonio's urban historic districts.

RECOMMENDATION:

Staff recommends approval of items #1 through #3 with the stipulation that the panels be mounted flush to the roof slopes.

CASE MANAGER:

Edward Hall



Flex Viewer

Powered by ArcGIS Server

Printed: Apr 25, 2017

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1810 East Pyron Avenue

E Pyron Ave

San Juan Ditch

Celebrati

San Ant



1810 East Pyron Avenue

San Juan Ditch

Pyron Ave

Celebration Circle E Pyron Ave





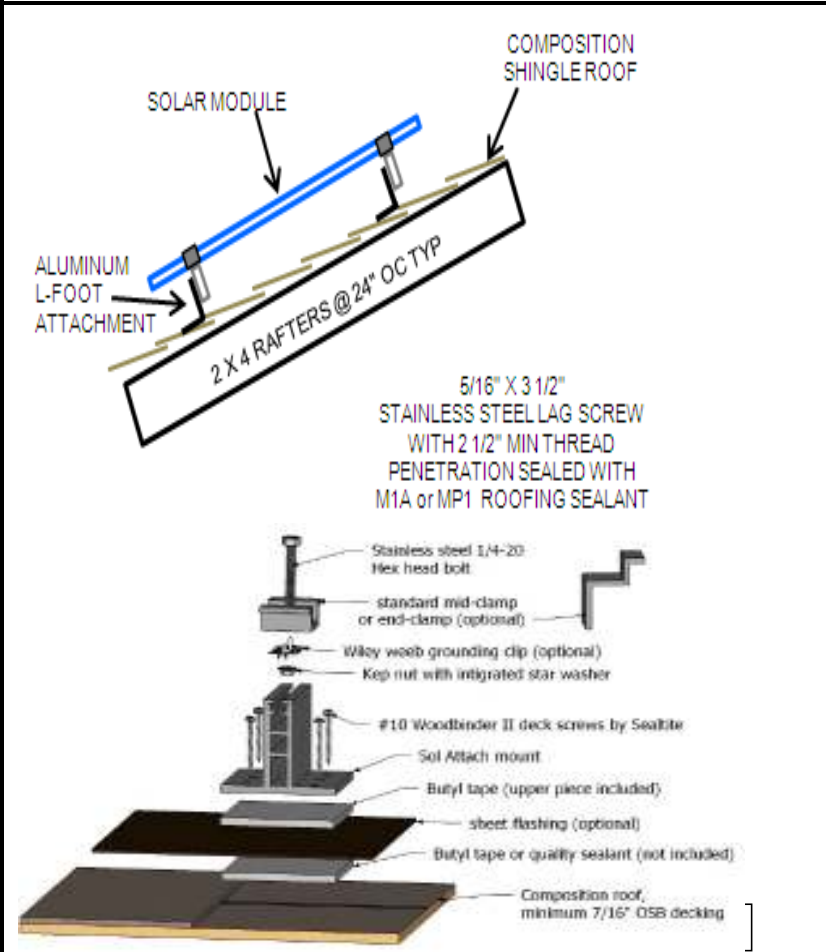






PV SITE LAYOUT

1



SIGNAGES PER NEC 690.17 & 705.10-705.12:

PV AC DISCONNECT: (2014 NEC ARTICLES: 690.17, 690.53)

PV SYSTEM DC DISCONNECT
RATED MAX. POWER-POINT CURRENT: XXX ADC
RATED MAX. POWER-POINT VOLTAGE: XXX VDC
MAXIMUM SYSTEM VOLTAGE: XXX VDC
SHORT-CIRCUIT CURRENT: XXX ADC

WARNING: ELECTRIC SHOCK HAZARD
TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

PV AC DISCONNECT: (2014 NEC ARTICLES: 690.54)

PV SYSTEM AC DISCONNECT
RATED AC OUTPUT CURRENT: XXX AMPS
NOMINAL OPERATING AC VOLTAGE: XXX VOLTS

PV METER SOCKET:

PV METER

WARNING: ELECTRIC SHOCK HAZARD
TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

INVERTER OUTPUT CONNECTION: (2014 NEC ARTICLE 705.12 D-2 B)

WARNING: INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE

CUSTOMER SERVICE PANEL: (2014 NEC ARTICLE 705.10)

WARNING: THIS PREMISE IS SUPPLIED BY MORE THAN ONE SOURCE OF ELECTRIC POWER (UTILITY, PV, XXX)

CPS ENERGY REVENUE METER SOCKET:

REVENUE METER

PV AGGREGATION PANEL:

DO NOT REMOVE, ADD OR RELOCATE ANY CIRCUITS FROM THIS PANEL

TRANSFORMERLESS OR NON-ISOLATED INVERTERS ONLY:

WARNING
ELECTRIC SHOCK HAZARD
THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE

NOTES:

- 1- CUSTOMERS SHALL BE RESPONSIBLE FOR COMPLYING WITH THE NEC AND OTHER APPLICABLE CODES ON ALL LABELING THAT IS REQUIRED FOR OTHER COMPONENTS OF THE PV SYSTEM INSTALLATION.
- 2- LABELING SHALL MEET THE FOLLOWING REQUIREMENTS:
 - A) REFLECTIVE, WEATHER RESISTANT AND SUFFICIENT DURABILITY TO WITHSTAND THE ENVIROMENT INVOLVED.
 - B) RED BACKGROUND WITH WHITE LETTERING.
 - C) MINIMUM 3/8" TALL CHARACTERS (SIZE MAY BE REDUCED ONLY WHEN NECESSARY TO FIT ON EQUIPMENT)
 - D) ADHESIVE FOR ALL LABELING SHALL BE WEATHER RESISTANT AND OF SUFFICIENT DURABILITY TO WITH STAND THE ENVIROMENT INVOLVED.
- 3- PERMANENT PLACARDS DENOTING LOCATIONS SHALL BE PLACED AT BOTH THE PV METER AND REVENUE METER WHERE A VARIANCE HAS BEEN APPROVED FOR THE METERS TO BE PLACED REMOTE.
- 4- LABELING WARNING THAT THERE ARE DUAL SOURCES SUPPLYING SHALL ALSO BE PLACED ON THE JUNCTION BOX USED ON LINE-SIDE

CONSTRUCTION NOTES:

1. ALL EQUIPMENT TO BE LISTED OR LABLED FOR ITS APPLIATION.
2. INSTALLATION TO BE COMPLIANT WITH THE NEC.
3. MODULE GROUNDNG METHOD SHALL BE WEEB UGC AND WEEB LUGS.
4. ALL CONDUCTORS ARE COPPER, UNLESS OTHERWISE SPECIFIED.
5. 3.0 PSF MAX DEAD LOAD CONTRIBUTED FROM SOLAR ARRAY

LEGEND

---	=	EQUIPMENT GROUNDING CONDUCTORS	—	=	CIRCUIT CONDUCTORS
L1	=	LINE 1 TERMINAL (PHASED BLACK)	L2	=	LINE 2 TERMINAL (PHASED RED)
N	=	NEUTRAL TERMINAL (PHASED WHITE)	G	=	GROUND TERMINAL (PHASED GREEN)
+	=	POSITIVE TERMINAL (PHASED BLACK)	-	=	NEGATIVE TERMINAL (PHASED WHITE)
⚡	=	FUSE	⏏	=	CIRCUIT BREAKER

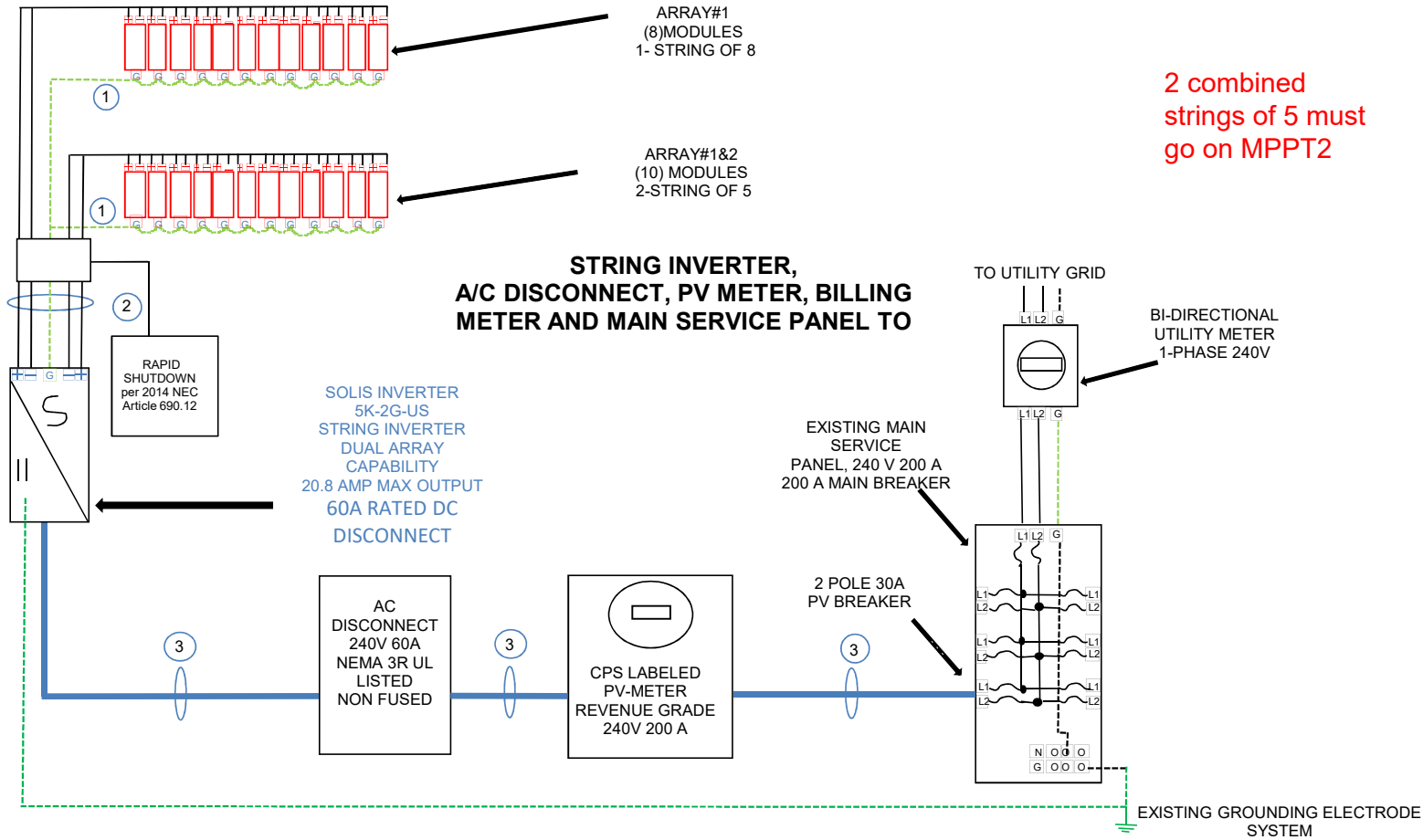
DESCRIPTION	DATE	REV
ORIGINAL	2/28/2017	A
REVISED		B
REVISED		C
Mstr Elect#	96107	
DESIGN & DRAFTING BY: Advanced Solar and Electric llc Master Electrician: James D. Flores, Sr		

3 WIRING DIAGRAM

Residential SOLAR ARRAY 6.30 kW D/C
Qty 18 Mission (72c) MSE350SQ4S Modules

- 1 #8 BARE COPPER GROUND
- 4-#10 USE-2 MC4-W/CONNECTORS TO MODULES, #8 GRND, IN 3/4" EMT
- 1-#8 THWN-2, 2-#8THWN-2 #8 GRND, IN 1" EMT
- 1-#6 THWN-2, 2-#6THWN-2, IN 1" EMT

2 combined strings of 5 must go on MPPT2



Ronald Bechtol

1810 E. Pyron Ave

San Antonio TX 78223

Residential Application

TECL #27328

SHEET TITLE:

PHOTOVOLTAIC

INSTALLATION

PAGE NUMBER:

PV-1

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Advanced Solar and Electric L.L.C.

105 W. Loop 539, Cibolo, Texas 78108 (210) 556-1399 www.advancedsolar.com sales@advancedsolar.com

TECL# 27328

Site Survey Worksheet

CUSTOMER:	Ronald Bechtol	DATE:	February 22, 2017
JOB SITE:	1810 E. Pyron Ave	w Phone:	210 573-7590
CITY / ST / ZIP	San Antonio 78223 TX	c Phone:	210 573-7590
EMAIL	ronbechtol@hotmail.com	1 or 2 Story:	One Story
Proposed System	6.300 (D/C KW capacity)	AHJ:	COSA
Panel Configuration	QTY 18	350	Mission (72c) MSE350SQ4S
Inverter Configuration	QTY 1	Solis	Solis-5K-2G-US (240V)
Inverter Configuration	QTY 0	Solis	0
Roof Type	Composite Shingle	Drawn By:	Rick
		Rep:	Joel Alderman

2 combined strings of 5 must go on MPPT2

All Arrays

Tilt:

Azimuth:

QTY	18
KW d/c	6.30
(CPSE only) KW a/c	5.64
NREL Default kWh	9135
NREL Actual kWh:	8583
% Default	93.96%

Array #1	Array #2	Array #3	Array #4
25.0	25.0		
100	190		
13	5		
4.55	1.75	0.00	0.00
6598	2538	0	0
5965	2618	0	0
90.41%	103.17%		



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105 W. Loop 539, Cibola, Texas 78108 (210) 556-1399 www.advancedsolar.com sales@advancedsolar.com

Site Survey Worksheet

CUSTOMER:	Ronald Bechtol	DATE: #VALUE!
JOB SITE:	1810 E. Pyron Ave	PHONE #1: 210 873-7590
CITY / ST / ZIP	San Antonio TX	PHONE #2: 210 873-7590
EMAIL	ronbechtol@hotmail.com	TYPE: Residential





2.5kW to 5kW

Ginlong Solis US Version Single Phase Inverters



Leading Features

- Compact and lightweight design inside a corrosion-resistant NEMA 4X enclosure
- Easy to install and visually pleasing for indoor or outdoor installations
- Single Phase 240Vac and 208Vac output
- Up to 97.8% efficient with an ultra-low start up voltage
- Dual (2) MPPT designs with fast (< 5 sec.) MPPT response times
- Industry-leading (100-500Vdc) operating MPPT range
- Integrated Arc Fault Circuit Interrupt (AFCI) option
- RS485 Modbus communication protocol with Wi-Fi interface (optional GPRS)
- Web based data monitoring with downloadable Solis Web App.
- 10 Year Standard Warranty with extension options

Accessories & monitoring

WiFi Stick



Web Box



Rapid Shutdown Device



Contact us today.

t: 866.438.8408
e: sales@ginlong-usa.com
w: ginlong-usa.com

Manufacturer:

Ginlong Technologies
Ltd., Ningbo, Zhejiang
P.R. China

US Headquarters:

565 Metro Place South
/ Suite 3214, Dublin, OH
43017 USA



Technical Specification

Model

Energy Source

DC Values

Max Usable Input Current per MPPT (Amps)

Max Short Circuit Input Current (Amps)

Start-Up Voltage (Volts)

Max Voltage (Volts)

Operating MPPT Voltage Range (Volts)

Full Power MPPT Voltage Range (Volts)

Max Power per MPPT (Watts)

Number of MPPT

Inputs per MPPT

AC Values (208Vac and 240Vac)

Operating Voltage Range (Volts)

Operating Frequency Range (Hertz)

Ambient Operating Temperature Range (Celsius and Fahrenheit)

Operating Surroundings Humidity

Power Factor

Grid Current THD

Nominal Output Power (Watts)

Max Continuous Output Power (Watts)

Max Output Current for 240V Grid (Amps)

Efficiency

Peak Efficiency

CEC Weighted Efficiency

MPPT Efficiency

Protection

Max Overcurrent Protection Device (Amps)

Temperature Protection

DC Reverse Polarity Protection

Output Overvoltage Protection-Varistor

Islanding Protection

Integrated AFCI (DC arc fault circuit protection)

Integrated DC Switch

Rapid Shutdown

General Data

Dimensions (W*H*D)

Weight

Topology

Internal consumption

Enclosure Type

Cooling Concept

Noise Emissions (Typical)

Max operating altitude without derating

Compliance

Features

Display

Interface

Connections

Warranty

Solis- 2.5K-2G-US	Solis- 3K-2G-US	Solis- 3.6K-2G-US	Solis- 4K-2G-US	Solis- 4.6K-2G-US	Solis- 5K-2G-US
PV					
10 + 10 15.6+15.6	10 + 10 15.6+15.6	10 + 10 15.6+15.6	10 + 18 15.6+28.1	10 + 18 15.6+28.1	10 + 18 15.6+28.1
120Vdc					
600					
100-500					
125-500 3000	150-500 3600	180-500 4000	145-500 4000	165-500 4600	180-500 5000
2					
1	1	1	1 + 2	1 + 2	1 + 2
183-228(for 208V rate)/211-264(for 240V rated)					
59.3 - 60.5					
-25°C to 60°C / -13°F to 140°F					
0-100%Condensing					
0.9leading ... 0.9lagging					
<3%					
2500	3000	3600	4000	4600	5000
2800	3300	4000	4400	5000	5000
10.4	12.5	15.0	16.7	19.2	20.8
97.5%	97.5%	97.5%	97.8%	97.8%	97.8%
95.5%	96.5%	96.5%	97.0%	97.0%	97.0%
>99%					
20	20	20	30	30	30
Yes					
Yes					
Yes					
Yes					
Yes					
Optional					
13.3*25.9*6.8in (338*658*173mm)					
33.1 lb.		38.6 lb.			
Transformer-less					
<1W (Night)					
NEMA 4X					
Natural Convection					
<30 dBA					
13120					
CAN/CSAC22.2 N107.1, UL1741, IEEE1547, UL1998, UL1699B, FCC part15,Class B					
LCD, 2 × 20 Z					
RS485, WiFi/GPRS(Optional)					
Plugged 3/4" openings for bottom and side					
Standard 10 Year (Extendable to 20 Years)					



Made by Ginlong Technologies

t: 866.438.8408 | e: sales@ginlong-usa.com | w: www.ginlong-usa.com

MSE-350 PERC

High Power Module

MISSION SOLAR
ENERGY



Class Leading Output:
Up to 360W power



Advanced Technology:
PERC and 4 busbars drive
>18% module efficiency



Reduced System Costs:
Robust design, 1500V
and simple installation



Certified Reliability:
3X IEC, salt mist, ammonia

Proudly assembled in the USA

Mission Solar Energy is headquartered in San Antonio, TX with cell and module facilities onsite. Our team of more than 400 staff call Texas home and are devoted to producing high quality solar products and services. Our supply chain includes local and domestic vendors increasing our impact to the U.S. economy.



Assembled
in the USA

CERTIFICATIONS

IEC 61215/ IEC 61730/ IEC 61701
UL 1703: CSA



Independently Audited by
 SOLARBUYER



 PowerGuard
SPECIALTY INSURANCE SERVICES

*As there are different certification requirements in different markets, please contact your local Mission Solar Energy sales representative for the specific certificates applicable to the products in the region in which the products are to be used.



Outstanding performance with PERC

Passivated Emitter Rear Cell (PERC) technology provides excellent power output through advanced cell architecture.

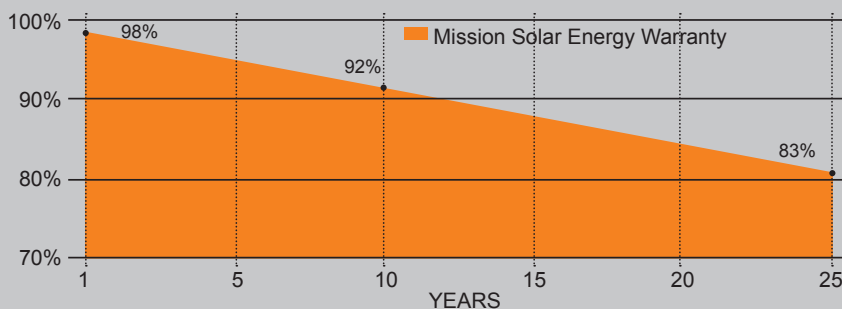
Best in class quality

Mission Solar Energy production lines are fully automated and include multiple quality checks throughout the production process including 3X EL Testing, 100% Visual inspection, and positive binning.

Proven reliability and bankability

Mission Solar Energy panels have been tested by independent testing centers to meet and exceed IEC standards. Its panels are already deployed in multiple installations.

25-YEAR LINEAR WARRANTY



ELECTRICAL SPECIFICATIONS

Electrical parameters at Standard Test Condition (STC)

Module Type			MSE345SQ4S	MSE350SQ4S	MSE355SQ4S	MSE360SQ4S	MSE365SQ4S
Power Output	P _{max}	Wp	345	350	355	360	365
Tolerance			0~+3%				
Short-Circuit Current	I _{sc}	A	9.70	9.73	9.76	9.79	9.81
Open Circuit Voltage	V _{oc}	V	46.98	47.38	47.68	48.08	48.12
Rated Current	I _{mp}	A	9.04	9.11	9.19	9.28	9.32
Rated Voltage	V _{mp}	V	38.43	38.68	38.98	39.28	39.32

TEMPERATURE COEFFICIENTS

Normal Operating Cell Temperature (NOCT)	44°C (±2°C)
Temperature Coefficient of P _{max}	-0.427%/°C
Temperature Coefficient of V _{oc}	-0.318%/°C
Temperature Coefficient of I _{sc}	0.042%/°C

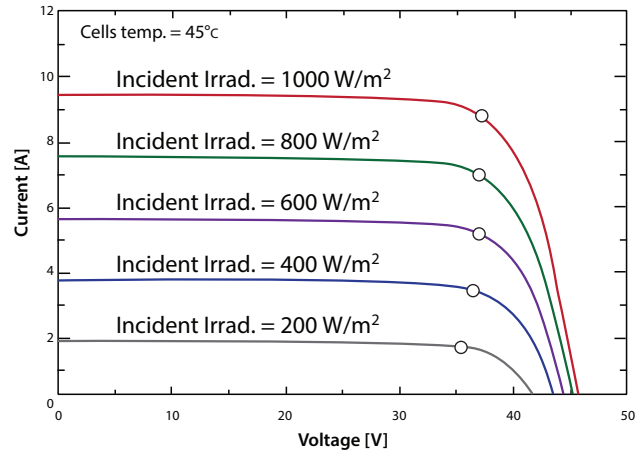
OPERATING CONDITIONS

Maximum System Voltage	1,500VDC for UL
Operating Temperature Range	-40°C (-40°F) to +90°C (194°F)
Maximum Series Fuse Rating	15A
Fire Safety Classification	Class C
Static Load Wind/Snow	2400Pa/5400Pa
Hail Safety Impact Velocity	25mm at 23 m/s

MECHANICAL DATA

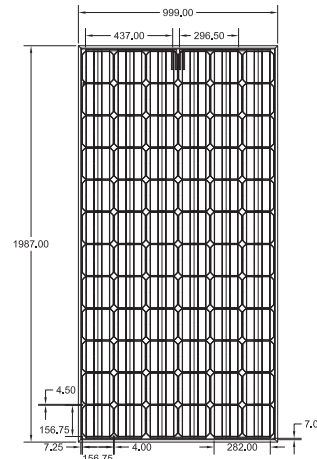
Solar Cells	P-type Mono-crystalline Silicon (6 in.)
Cell orientation	72 cells (6x12), 4 busbar
Module dimension	1987mm x 999mm x 40mm (78.23 in. x 39.33 in. x 1.57 in.)
Weight	21.6 kg (47.6 lb)
Front Glass	3.2mm (0.126 in.) tempered, Low-iron, Anti-reflective coating
Frame	Anodized aluminum alloy
Encapsulant	Ethylene vinyl acetate (EVA)
J-Box	Protection class IP67 with bypass-diode
Cables	PV wire, 1.2m (47.2 in.), 4mm ² / 12 AWG
Connector	MC4 or MC4 compatible

MSE360SQ4S: 360WP, 72CELL SOLAR MODULE CURRENT-VOLTAGE CURVE

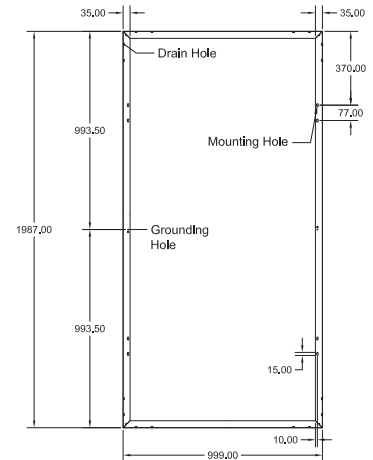


Current-voltage characteristics with dependence on irradiance and module temperature

BASIC DESIGN (UNITS: MM)



Front View



Back View



ABB solar system accessories

Rapid Shutdown for residential and small commercial



ABB now offers the only family of rapid shutdown products for string inverters today. This product provides a fail-safe solution for emergency responders to eliminate voltage at the PV array in compliance with NEC 2014 Rapid Shutdown code requirements.

The ABB Rapid Shutdown system requires no extra conduit; minimizing additional material cost and associated labor.

Shutdown occurs at the rooftop box when utility power is lost or when the PV system's AC disconnect switch is opened. In jurisdictions requiring a dedicated activation switch, an optional emergency stop button is available. The Rapid Shutdown box can mount directly to the PV mounting rail and lay parallel to the roofing surface. The NEMA 4X design permits installation angles from 0-90° while maintaining its water-tight seal from mounted snow or driven rain.

Three models are available to cover all system configurations; including, a two-string pass through, a two-string combined and a four-string combined box.

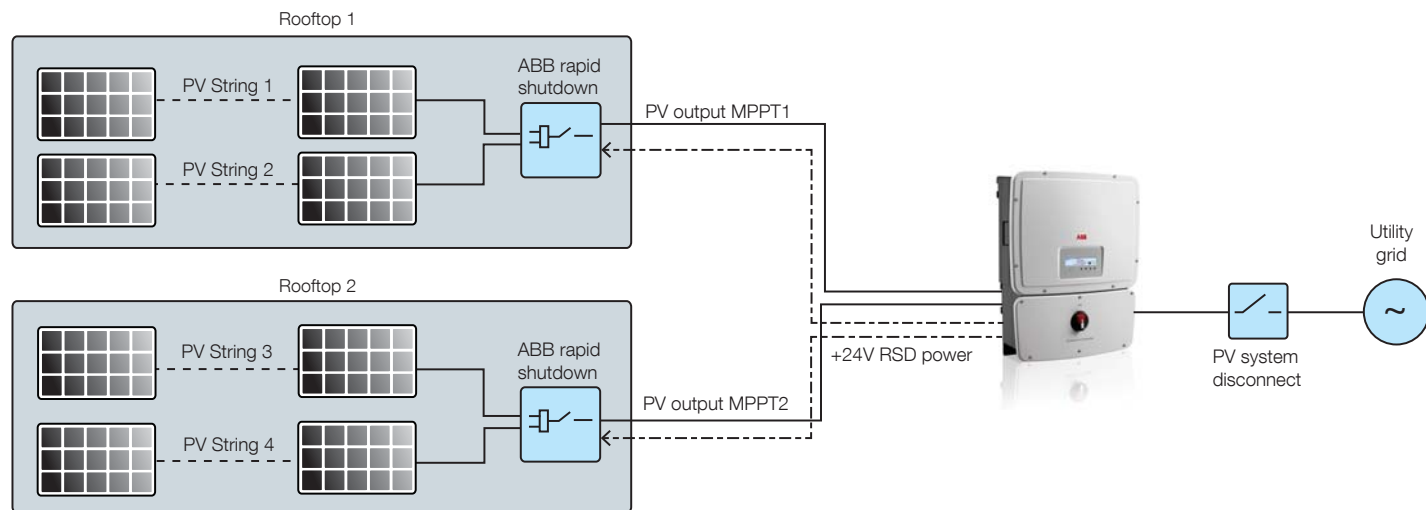
The unique features of each box can be used to maintain the specific configuration of the PV system. Dual outputs in the box maintain the benefits of ABB's dual MPPT inverter channels, while the single output box is perfect for small PV arrays utilizing one MPPT channel or systems requiring two rapid shutdown boxes.

To further reduce system cost, string combining models reduce the number of output conductors between the rooftop box and the inverter. The applicable rapid shutdown boxes include disconnect switches to comply with NEC 2014 690.15(C) *Direct-Current Combiner Disconnects*.

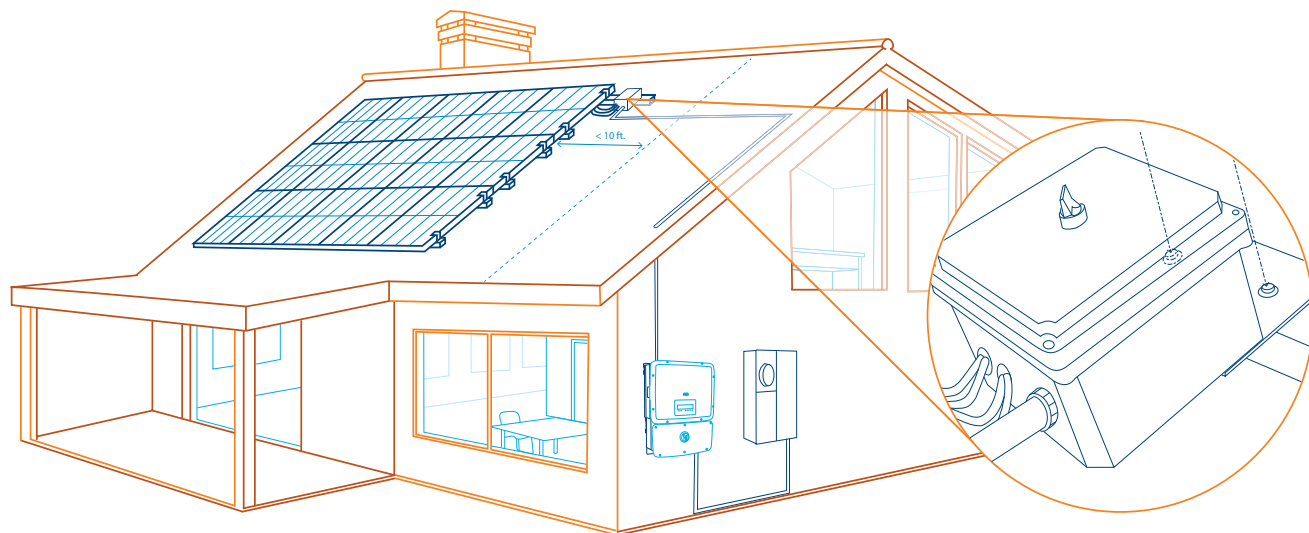
Highlights:

- Meets NEC 690.12 while avoiding the cost of additional conduit making this solution the most cost-effective rapid shutdown product available
- Immediately eliminates voltage and current upon activation
- NEMA 4X enclosure provides added protection from the harshest rooftop conditions
- Multiple string combining models available provide additional savings by reducing the number of DC conductors to the inverter
- Equipment disconnect included in string combining models provide safety and compliance with NEC 2014 combiner-disconnect requirements

Rapid shutdown wiring diagram: 2-RSD system



Two RS2-1CN6 boxes may be powered by one power supply. For PV systems requiring two RSD boxes order the RS2-1CN6- kit and one RS2-1CN6 box.

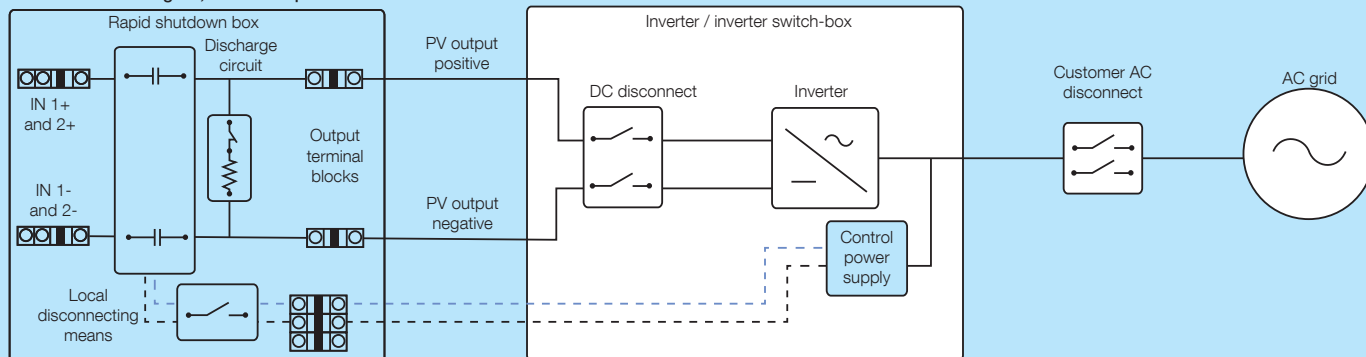


Technical data and types

Type code	2-String pass-through	2-String combined	4-String combined
PV source conductor input			
Max input current (per string)		11.25A	
Max input voltage		600V	
Number of input strings	2	2	4
Conductor size		14-8 AWG	
PV output conductors output			
Number of output circuits	2	1	2
Conductor size		12-6 AWG	
DC disconnect	N/A	Yes	Yes
Control power			
Power consumption	<5W, 24V/0.2A	<2.5W, 24V/0.1A	<5W, 24V/0.2A
Maximum power conductor size		12 AWG	
E-stop button		Optional	
Environmental			
Mounting angle		0-90°	
Dimensions H x W x D		10.54"x8.54"x5.32" (without mounting bracket)	
Weight	6lb	5.8lb	6.2lb
Operating temperature range		-25°C to +70°C	
Enclosure rating		NEMA 4X	
Certifications		UL1741:2010, FCC Part 15 Class B	
Warranty			
Standard warranty		10 Years	
Available models			
Rapid shutdown kit	RS2-2PN6-kit	RS2-1CN6-kit	RS4-2CN6-kit
Rapid shutdown rooftop box for 2-box system	N/A	RS2-1CN6	N/A
Optional emergency stop		1SFA611821R1026	

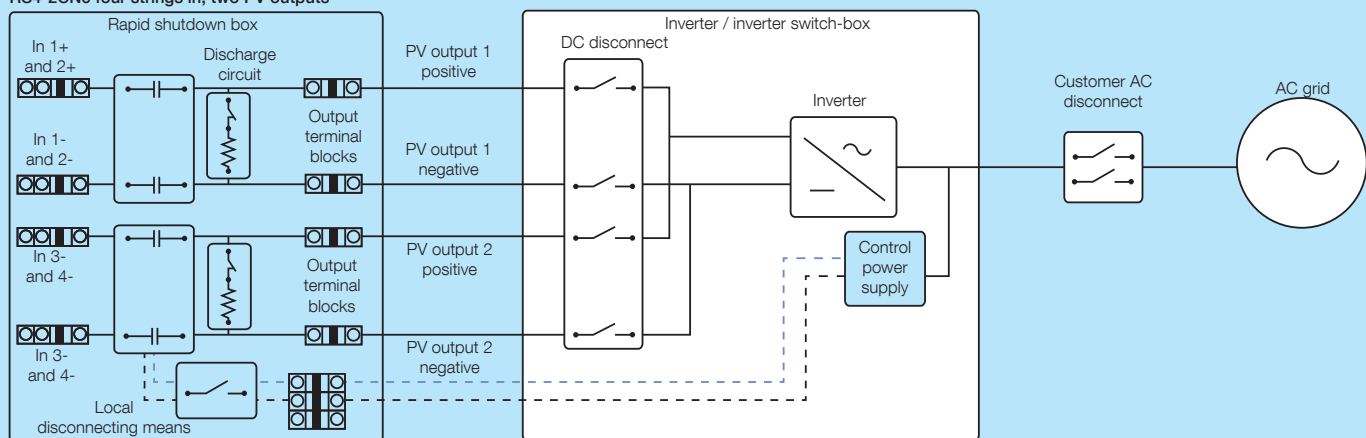
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RS2-1CN6 two strings in, one PV output



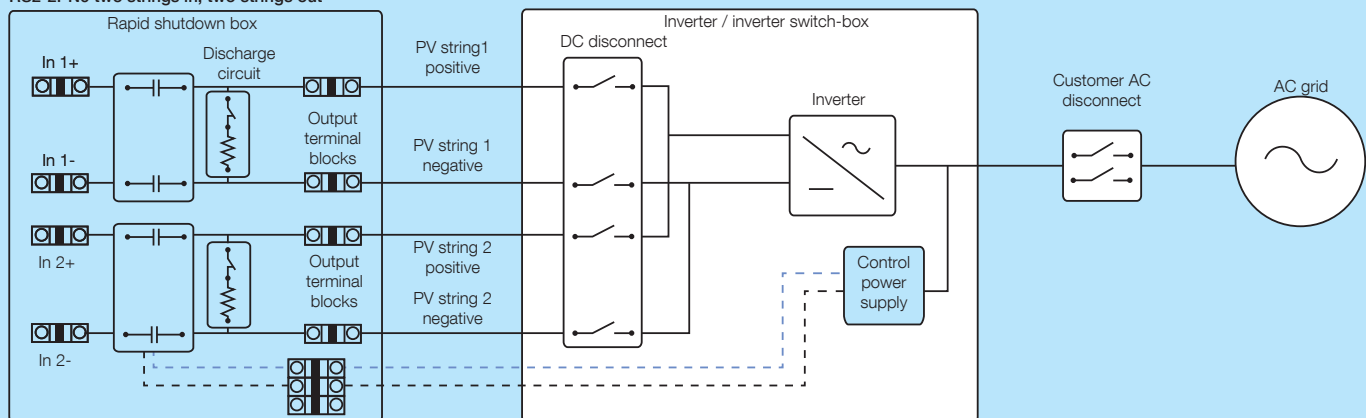
This 2-string model combines the strings to one PV output circuit. The RS2-1CN6 includes a disconnect switch on the front cover to disconnect the PV output conductors from the equipment downstream. Auxiliary terminals are provided for connecting an emergency stop button, if desired.

RS4-2CN6 four strings in, two PV outputs



This 4-string model combines 2-strings together in two separate PV output circuits. The RS4-2CN6 includes a disconnect switch on the front cover to disconnect the PV output conductors from the equipment downstream. Auxiliary terminals are provided for connecting an emergency stop button, if desired.

RS2-2PN6 two strings in, two strings out



The RS2-2PN6 is a 2-string pass-through with no string combining and no local disconnecting means included. Auxiliary terminals are provided for connecting an emergency stop button, if desired.

Support and service

ABB supports its customers with a dedicated, global service organization in more than 60 countries, with strong regional and national technical partner networks providing a complete range of life cycle services.

For more information please contact your local ABB representative or visit:

www.abb.com/solarinverters

www.abb.com

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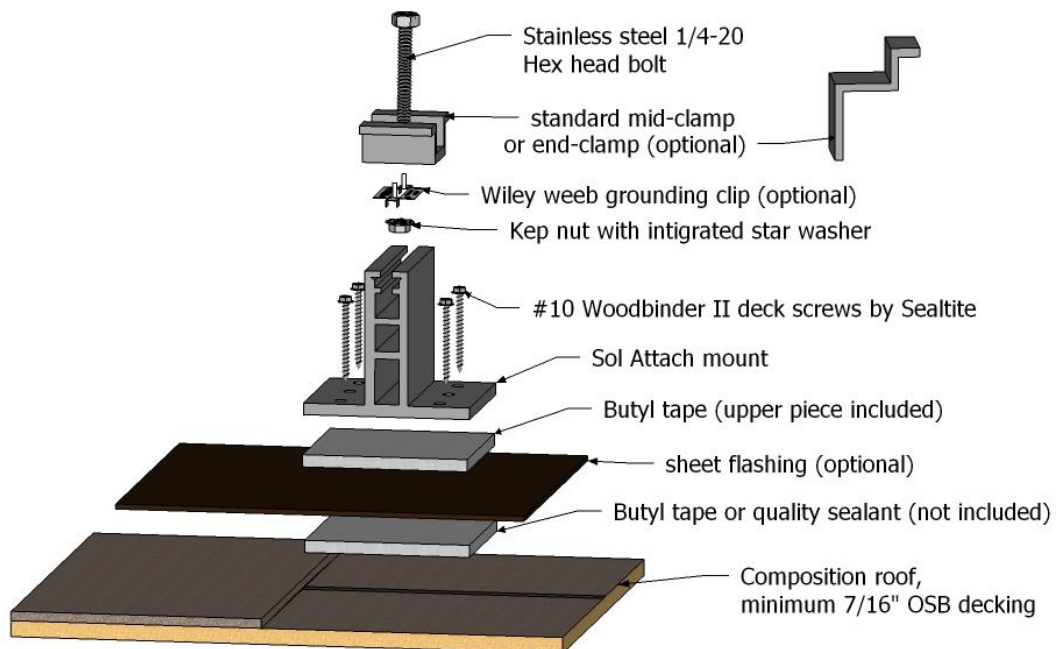
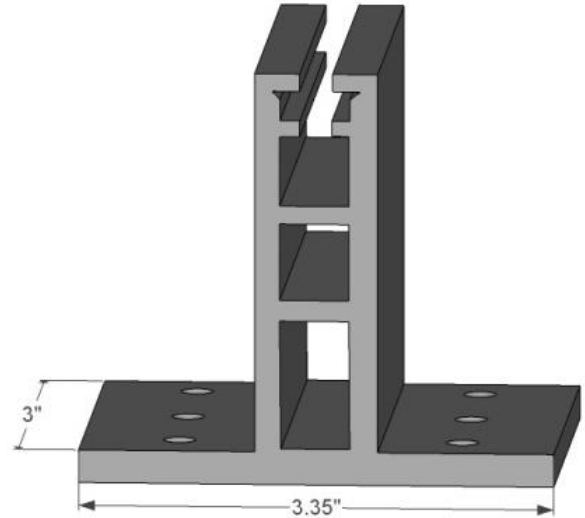
SOL ATTACH

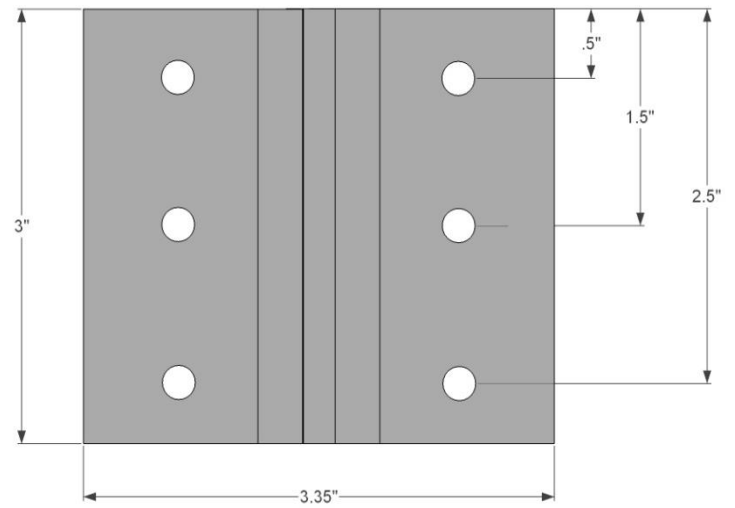
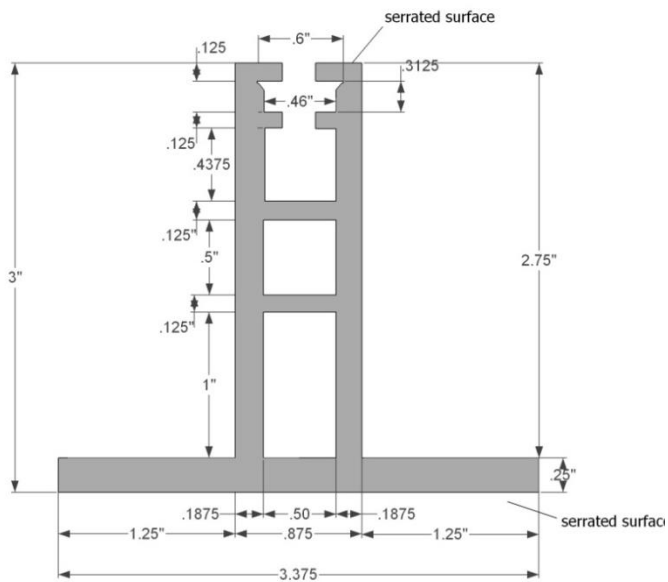
Sol Attach, LLC

Composition roof mounting foot

Extrusions made of 6061-T6 alloy

Patent Pending

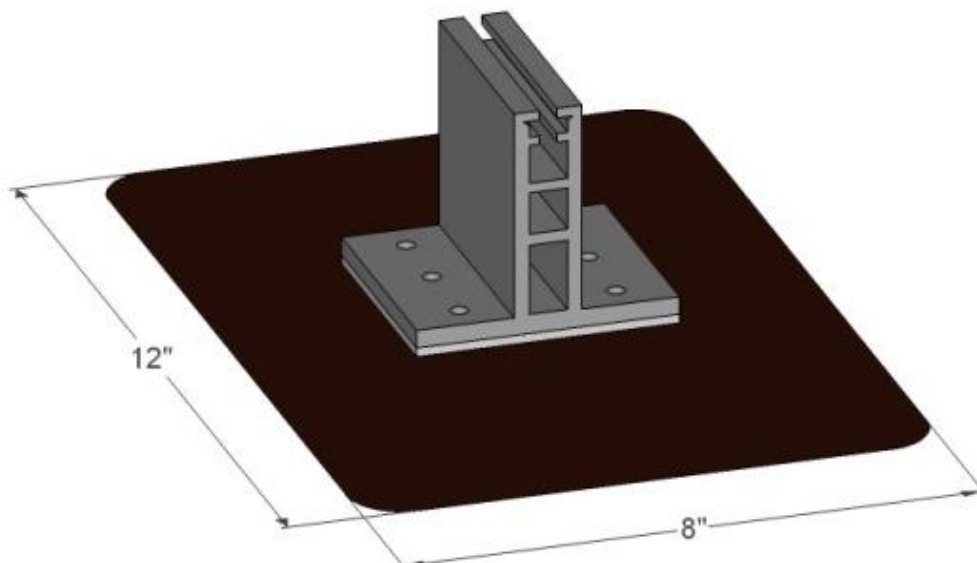




Weights:

Each single mount	6.6 oz
One mount with 4 deck screws and butyl tape	8.6 oz
One mount with screws, butyl, and mid-clamp	10.1 oz
One mount with screws, butyl, mid-clamp, and flashing	12.6 oz

Flat flashing



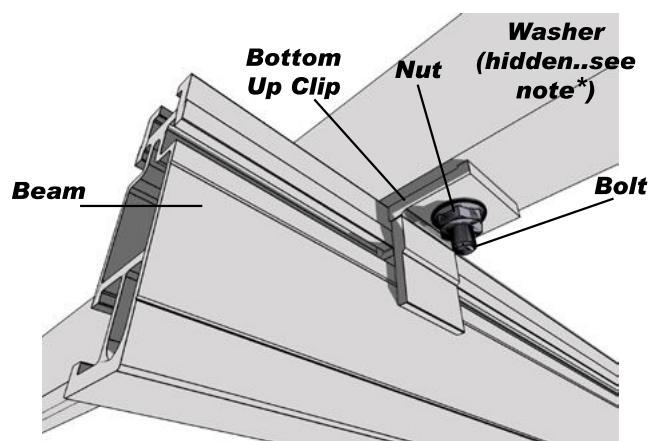
SOLARMOUNT Technical Datasheet

Pub 130817

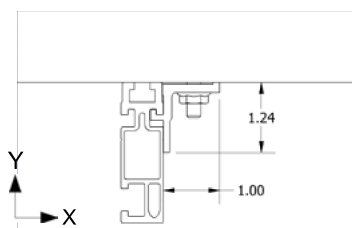
SOLARMOUNT Module Connection Hardware	1
Bottom Up Module Clip.....	1
Mid Clamp	2
End Clamp.....	2
SOLARMOUNT Beam Connection Hardware	3
L-Foot	3
SOLARMOUNT Beams	4

SOLARMOUNT Module Connection Hardware

SOLARMOUNT Bottom Up Module Clip Part No. 302000C



- **Bottom Up Clip material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear Anodized
- **Bottom Up Clip weight:** ~0.031 lbs (14g)
- Allowable and design loads are valid when components are assembled with SOLARMOUNT series beams according to authorized UNIRAC documents
- Assemble with one ¼"-20 ASTM F593 bolt, one ¼"-20 ASTM F594 serrated flange nut, and one ¼" flat washer
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
- Module edge must be fully supported by the beam
- * **NOTE ON WASHER:** Install washer on bolt head side of assembly. **DO NOT** install washer under serrated flange nut

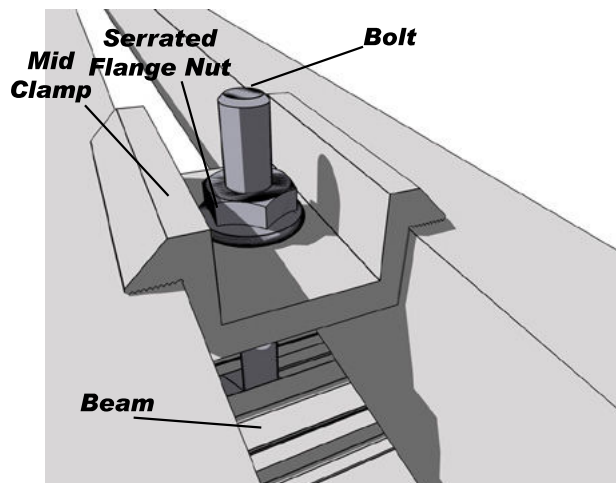


Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, Φ
Tension, Y+	1566 (6967)	686 (3052)	2.28	1038 (4615)	0.662
Transverse, X±	1128 (5019)	329 (1463)	3.43	497 (2213)	0.441
Sliding, Z±	66 (292)	27 (119)	2.44	41 (181)	0.619

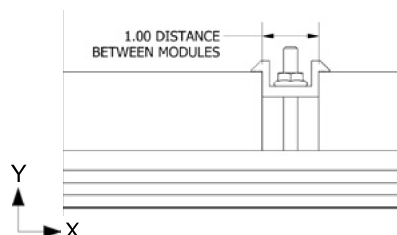
Dimensions specified in inches unless noted

SOLARMOUNT Mid Clamp

Part No. 302101C, 302101D, 302103C, 302104D,
302105D, 302106D



- **Mid clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **Mid clamp weight:** 0.050 lbs (23g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single mid clamp assembly when used with a SOLARMOUNT series beam to retain a module in the direction indicated
- Assemble mid clamp with one Unirac 1/4"-20 T-bolt and one 1/4"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory

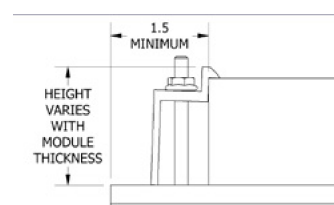
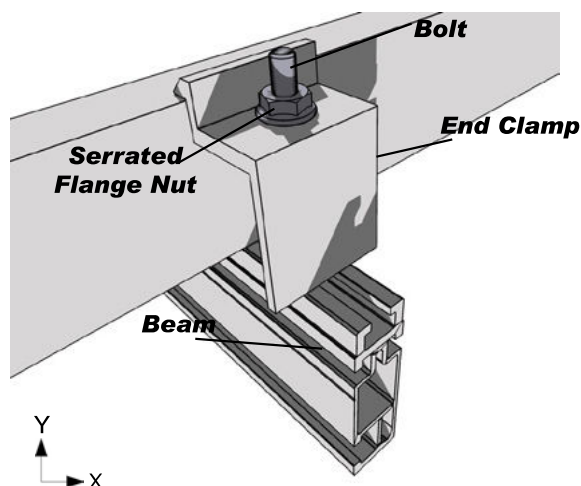


Dimensions specified in inches unless noted

Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, Φ
Tension, Y+	2020 (8987)	891 (3963)	2.27	1348 (5994)	0.667
Transverse, Z±	520 (2313)	229 (1017)	2.27	346 (1539)	0.665
Sliding, X±	1194 (5312)	490 (2179)	2.44	741 (3295)	0.620

SOLARMOUNT End Clamp

Part No. 302001C, 302002C, 302002D, 302003C,
302003D, 302004C, 302004D, 302005C, 302005D,
302006C, 302006D, 302007D, 302008C, 302008D,
302009C, 302009D, 302010C, 302011C, 302012C



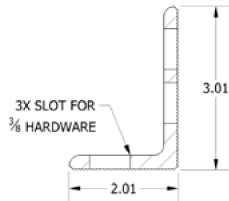
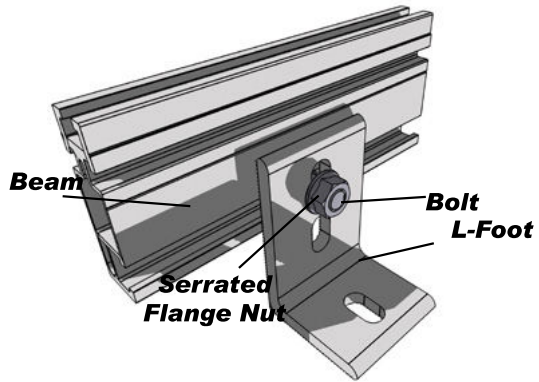
Dimensions specified in inches unless noted

- **End clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **End clamp weight:** varies based on height: ~0.058 lbs (26g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single end clamp assembly when used with a SOLARMOUNT series beam to retain a module in the direction indicated
- Assemble with one Unirac 1/4"-20 T-bolt and one 1/4"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
- Modules must be installed at least 1.5 in from either end of a beam

Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Loads lbs (N)	Resistance Factor, Φ
Tension, Y+	1321 (5876)	529 (2352)	2.50	800 (3557)	0.605
Transverse, Z±	63 (279)	14 (61)	4.58	21 (92)	0.330
Sliding, X±	142 (630)	52 (231)	2.72	79 (349)	0.555

SOLARMOUNT Beam Connection Hardware

SOLARMOUNT L-Foot Part No. 304000C, 304000D



Dimensions specified in inches unless noted

- **L-Foot material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **L-Foot weight:** 0.215 lbs (98g)
- Allowable and design loads are valid when components are assembled with SOLARMOUNT series beams according to authorized UNIRAC documents
- **For the beam to L-Foot connection:**
 - Assemble with one ASTM F593 $\frac{3}{8}$ "-16 hex head screw and one ASTM F594 $\frac{3}{8}$ " serrated flange nut
 - Use anti-seize and tighten to 30 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory

NOTE: Loads are given for the L-Foot to beam connection only; be sure to check load limits for standoff, lag screw, or other attachment method

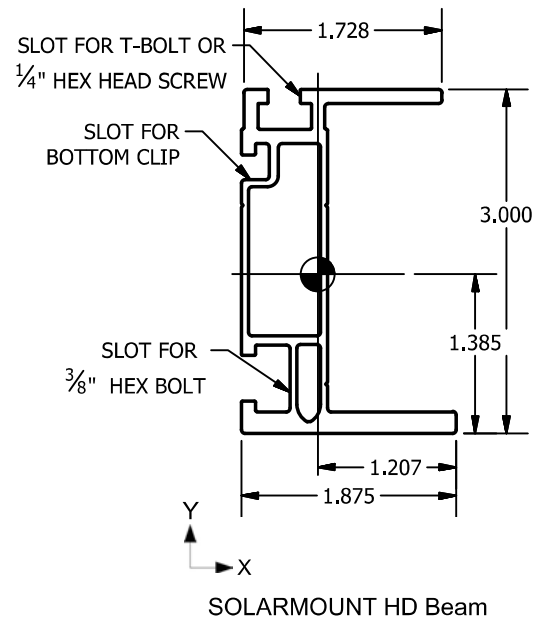
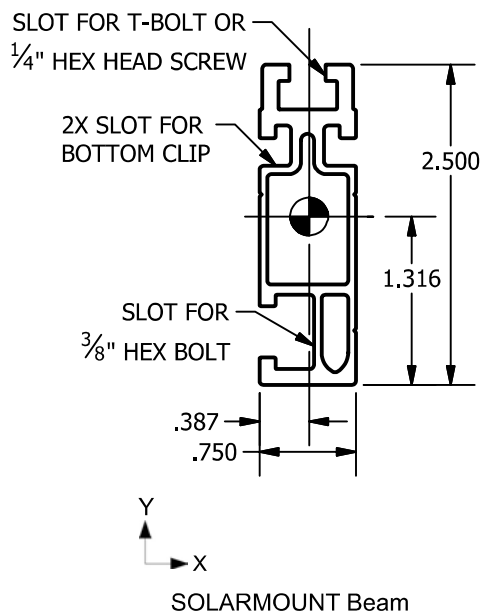
Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, Φ
Sliding, Z \pm	1766 (7856)	755 (3356)	2.34	1141 (5077)	0.646
Tension, Y+	1859 (8269)	707 (3144)	2.63	1069 (4755)	0.575
Compression, Y-	3258 (14492)	1325 (5893)	2.46	2004 (8913)	0.615
Traverse, X \pm	486 (2162)	213 (949)	2.28	323 (1436)	0.664

SOLARMOUNT Beams

Part No. 310132C, 310132C-B, 310168C, 310168C-B, 310168D
310208C, 310208C-B, 310240C, 310240C-B, 310240D,
410144M, 410168M, 410204M, 410240M

Properties	Units	SOLARMOUNT	SOLARMOUNT HD
Beam Height	in	2.5	3.0
Approximate Weight (per linear ft)	plf	0.811	1.271
Total Cross Sectional Area	in ²	0.676	1.059
Section Modulus (X-Axis)	in ³	0.353	0.898
Section Modulus (Y-Axis)	in ³	0.113	0.221
Moment of Inertia (X-Axis)	in ⁴	0.464	1.450
Moment of Inertia (Y-Axis)	in ⁴	0.044	0.267
Radius of Gyration (X-Axis)	in	0.289	1.170
Radius of Gyration (Y-Axis)	in	0.254	0.502

* Rails are extruded using these aluminum alloys: 6005-T5, 6105-T5, 6061-T6



Dimensions specified in inches unless noted

May 22, 2014

Sol Attach, LLC
Attn: Kevin Stapleton
16238 Bear Run
San Antonio, TX 78247



Texas Registered Engineering Firm #1979

Re: Solar Mounting System for Pitched Rooftops with Sol Attach Roof Mounting System in **Texas**

To Whom It May Concern:

Anchor Engineering, Inc. has reviewed the Sol Attach Roof Mounting System for the design assumptions outlined below and we have concluded that the Sol Attach Roof Mounting System is in compliance with the following codes/standards.

1. ASCE 7-05 – Minimum Design Loads for Buildings and Other Structures, by ASCE/SEI, 2005.
2. ASCE 7-10 – Minimum Design Loads for Buildings and Other Structures, by ASCE/SEI, 2010.
3. 2006 IBC/ 2009 IBC/ 2012 IBC, by International Code Council, 2006/2009/2012.
4. 2006 IRC/ 2009 IRC/ 2012 IRC, by International Code Council, 2006/2009/2012.

Design Assumptions:

- Maximum mean roof height of no more than 30'-0" as defined by ASCE 7-05/ASCE 7-10.
- Importance Factor of no more than 1.0 as defined by ASCE 7-05/ASCE 7-10.
- Dry service conditions.
- Array may be located within roof zones 1, 2, or 3.
- Analysis of the mount is based upon the maximum effects of either the largest gravity loads or wind uplift loads. The point loads (either positive or negative) can act in either direction depending upon the type of loading (i.e. wind, snow...etc.).
- Fasteners installed per manufacturer specifications.
- When using the Sol Attach, four PV mounts per PV module such that adjacent modules share two PV mounts.
- Use two Sol Attach per side unless noted otherwise (See charts below).
- At end clamp locations the Sol Attach Mount is only activated by one half of the panel.
- Snow load = 5 psf.

Product Specifications:

- Aluminum alloy is 6061-T6.
- Kwikseal II Woodbinder Screws. The screws must penetrate the sheathing fully and have a minimum of three threads exposed.
- (3) screws per Sol Attach Mount at end clamp locations.

Module Specifications:

- Modules may be installed in landscape or portrait orientation.
- Modules may have a maximum short side dimension of 39.1".
- Modules may have a maximum long side dimension of 77.1".
- Modules may be a maximum of 59.5lb.

Roof Pitch: 7-27°			
Wind Speed, (V_{ult})	Wind Speed, (V_{asd})	Exposure	Fastener Req'd per Sol Attach w/ 7/16" OSB
155 mph $\geq x$	120 mph $\geq x$	C	(6) Screws
155 mph $\geq x > 148$ mph	120 mph $\geq x > 115$ mph	B	(6) Screws
148 mph $\geq x$	115 mph $\geq x$	B	(4) Screws

Roof Pitch: 27-45°			
Wind Speed, (V_{ult})	Wind Speed, (V_{asd})	Exposure	Fastener Req'd per Sol Attach w/ 7/16" OSB
155 mph $\geq x >$	120 mph $\geq x$	B, C	(4) Screws

Module Specifications:

- Modules may be installed in landscape or portrait orientation.
- Modules may have a maximum short side dimension of 39.1".
- Modules may have a maximum long side dimension of 77.1".
- Modules may be a maximum of 59.5lb.

Please see attached data sheets for the Sol Attach Roof Mounting System specification sheet.

The Sol Attach Roof Mounting System was evaluated for pull-out resistance of the fasteners and punching shear in the OSB. Review of any building structural element is outside the scope of this letter.

Should questions arise, or if further information is required, please contact our office.

Sincerely,
Anchor Engineering, Inc.

Reviewed by:



Dustin C. Stallings, E.I.
Design Engineer I



David A. Poe, P.E., S.E.
Principal Engineer



Product Service

Compliance Document

No. D 15 06 86470 008

Holder of Certificate: Ningbo Ginlong Technologies Co., Ltd.

No.57 Jintong Road
Binhai Industrial Park, Xiangshan
315712 Ningbo, Zhejiang
PEOPLE'S REPUBLIC OF CHINA

Product:

Converter
Grid-connected photovoltaic inverter

This Compliance document confirms the compliance with the listed standards on a voluntary basis. It refers only to the sample submitted for testing and certification and does not certify the quality or safety of the serial products. See also notes overleaf.

Test report no.:

704091364708-00

**Date,** 2015-06-08

Zhangdong Ma
(Zhengdong Ma)

Page 1 of 4



Product Service

Compliance Document No. D 15 06 86470 008

Model(s): Solis-xK-2G, GCI-xK-2G,
GCI-xK-2G-W, GCI-xK-2G-H
(x=1, 1.5, 2, 2.5, 3, 3.6, 4, 4.6 or 5,
indicates different output powers)

Parameters:

PDC max:	See attachment
UDC max:	See attachment
UDC startup:	See attachment
VDC MPPT range:	See attachment
IDC max:	See attachment
I _{pv} max short circuit:	See attachment
Rated output voltage:	230V
Rated output frequency:	50Hz
IAC max:	See attachment
PAC max:	See attachment
PF:	1 (at rated power)
Protection class:	I
Degree of protection:	IP65
Overvoltage category:	III[MAINS], II[PV]
Ambient temperature:	-25°C to +60°C
See attachments for more details	

Tested according to:

IEC 61727(ed.2)
IEC 62116(ed.2)

2011/04/11

Compliance Document

No. D 15 06 86470 008



Product Service

Model Parameters	Solis-1K-2G	Solis-1.5K-2G	Solis-2K-2G	Solis-2.5K-2G	Solis-3K-2G	Solis-3.6K-2G	Solis-4K-2G	Solis-4.6K-2G	Solis-5K-2G
PDC max (W)	1200	1800	2300	3000	3500	4200	4600	5300	5300
UDC max (V d.c.)	500	500	500	600	600	600	600	600	600
VDC startup	80	120	120	120	120	120	120	120	120
VDC MPPT range (V d.c.)	70-400	100-400	100-400	100-500	100-500	100-500	100-500	100-500	100-500
IDC max (A d.c.)	10	10	10	10/10	10/10	10/10	15/15	15/15	15/15
I _{pv} max short circuit (A d.c.)	12	12	12	12/12	12/12	12/12	20/20	20/20	20/20
PAC max (W)	1100	1700	2200	2800	3300	4000	4400	5000	5000
IAC max (A)	5.2	8.1	10.5	13.3	15.7	16	21	23.8	23.8

Model Parameters	GCI-1K-2G	GCI-1.5K-2G	GCI-2K-2G	GCI-2.5K-2G	GCI-3K-2G	GCI-3.6K-2G	GCI-4K-2G	GCI-4.6K-2G	GCI-5K-2G
PDC max (W)	1200	1800	2300	3000	3500	4200	4600	5300	5300
UDC max (V d.c.)	500	500	500	600	600	600	600	600	600
VDC startup	80	120	120	120	120	120	120	120	120
VDC MPPT range (V d.c.)	70-400	100-400	100-400	100-500	100-500	100-500	100-500	100-500	100-500
IDC max (A d.c.)	10	10	10	10/10	10/10	10/10	15/15	15/15	15/15
I _{pv} max short circuit (A d.c.)	12	12	12	12/12	12/12	12/12	20/20	20/20	20/20
PAC max (W)	1100	1500	2200	2800	3300	4000	4400	5000	5000
IAC max (A)	5.2	8.1	10.5	13.3	15.7	16	21	23.8	23.8

Compliance Document No. D 15 06 86470 008



Product Service

Model Parameters	GCI-1K- 2G-W	GCI- 1.5K- 2G-W	GCI-2K- 2G-W	GCI- 2.5K- 2G-W	GCI-3K- 2G-W	GCI- 3.6K- 2G-W	GCI-4K- 2G-W	GCI- 4.6K- 2G-W	GCI-5K- 2G-W
PDC max (W)	1200	1800	2300	3000	3500	4200	4600	5300	5300
UDC max (V d.c.)	500	500	500	600	600	600	600	600	600
VDC startup	80	120	120	120	120	120	120	120	120
VDC MPPT range (V d.c.)	70-400	100-400	100-400	100-500	100-500	100-500	100-500	100-500	100-500
IDC max (A d.c.)	10	10	10	10/10	10/10	10/10	15/15	15/15	15/15
I _{pv} max short circuit (A d.c.)	12	12	12	12/12	12/12	12/12	20/20	20/20	20/20
PAC max (W)	1100	1500	2200	2800	3300	4000	4400	5000	5000
IAC max (A)	5.2	8.1	10.5	13.3	15.7	16	21	23.8	23.8

Model Parameters	GCI-1K- 2G-H	GCI- 1.5K- 2G-H	GCI-2K- 2G-H	GCI- 2.5K- 2G-H	GCI-3K- 2G-H	GCI- 3.6K- 2G-H	GCI-4K- 2G-H	GCI- 4.6K- 2G-H	GCI-5K- 2G-H
PDC max (W)	1200	1800	2300	3000	3500	4200	4600	5300	5300
UDC max (V d.c.)	500	500	500	600	600	600	600	600	600
VDC startup	80	120	120	120	120	120	120	120	120
VDC MPPT range (V d.c.)	70-400	100-400	100-400	100-500	100-500	100-500	100-500	100-500	100-500
IDC max (A d.c.)	10	10	10	10/10	10/10	10/10	15/15	15/15	15/15
I _{pv} max short circuit (A d.c.)	12	12	12	12/12	12/12	12/12	20/20	20/20	20/20
PAC max (W)	1100	1500	2200	2800	3300	4000	4400	5000	5000
IAC max (A)	5.2	8.1	10.5	13.3	15.7	16	21	23.8	23.8

Handwritten signature

Certificate



Certificate no.

US 82140038 01

License Holder:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Manufacturing Plant:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Test report no.: USA-31440029 001

Client Reference: John Nagyvary

Tested to: Subject 2703 No. 2 (11-13-2012)

Certified Product: Module Rack Mounting System

License Fee - Units

Model Designation: SolarMount (SM)

7

Maximum Size of PV Module: 65" long and 39.125" wide

Maximum System Voltage of PV Module: 1000 VDC

Maximum overcurrent protection rating of PV Module: 30 A

Fire Rating: Class A when installed with

- Type 1 fire rated modules,
- Type 2 fire rated modules,
- Type 3 fire rated modules,
- Type 10 fire rated modules.

(continued)

7

Appendix: 1,1-4

Licensed Test mark:



Date of Issue

(day/mo/yr)

19/12/2014

Certificate



Certificate no.

US 82140038 02

License Holder:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Manufacturing Plant:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Test report no.: USA-31440029 001

Client Reference: John Nagyvary

Tested to: Subject 2703 No. 2 (11-13-2012)

Certified Product: Module Rack Mounting System

License Fee - Units

(continued)

7

Modules Evaluated & Qualified for Mechanical Load:

Trina Solar TSM-255PA05.08

Design Load: Positive = 112 psf, Negative = 50 psf

Centrosolar TP6 250 SW and E 250B

Design Load: Positive = 112 psf, Negative = 50 psf

TSMC Solar TS-150C2

Design Load: Positive = 35 psf, Negative = 35 psf

Modules from the same series with same frame are qualified
if their area is less than or equal to test module area.

(continued)

7

Appendix: 1,1-4

Licensed Test mark:



Date of Issue

(day/mo/yr)

19/12/2014

Certificate



Certificate no.

US 82140038 03

License Holder:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Manufacturing Plant:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Test report no.: USA-31440029 001

Client Reference: John Nagyvary

Tested to: Subject 2703 No. 2 (11-13-2012)

Certified Product: Module Rack Mounting System

License Fee - Units

(continued)

7

Modules Evaluated & Qualified for Electrical Bonding:

AU Optronics (BenQ Solar)	PM Series
Canadian Solar	CS5A-M, CS6P-M, CS6P-P, CSX-P
Centrosolar America	C-Series, E-Series
ET Solar	ET AC Module, ET Module
Hanwha SolarOne	HSL 60
Hyundai Heavy Industries	MG Series
Kyocera	KD-F Series
LG Electronics	Mono Neon, Mono X
Phono Solar Technology	All Standard Modules

(continued)

7

Appendix: 1,1-4

Licensed Test mark:



Date of Issue

(day/mo/yr)

19/12/2014

Certificate



Certificate no.

US 82140038 04

License Holder:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Manufacturing Plant:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Test report no.: USA-31440029 001

Client Reference: John Nagyvary

Tested to: Subject 2703 No. 2 (11-13-2012)

Certified Product: Module Rack Mounting System

License Fee - Units

(continued)

7

Modules Qualified for Electrical Bonding [continued]

Renesola	All 60-cell Modules
Sharp	ND240QCJ, ND240QCS, NDQ235F4
Suniva	MV Series, OPTIMUS Series
SunPower	AC, E-Series, Sig Black, X-Series
Suntech	STP XXX
Trina	PD05, PA05
Yingli	Panda 60, YGE 60
Yingli	YGE-Z 60
Sun Edison / MEMC	F-Series, R-Series
SolarWorld	SunModule Protect, SunModule Plus

7

Appendix: 1,1-4

Licensed Test mark:



Date of Issue

(day/mo/yr)

19/12/2014

Certificate



Certificate no.

US 82140038 05

License Holder:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Manufacturing Plant:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Test report no.: USA- 31440029 003

Client Reference: Tom Young

Tested to: Subject 2703 No. 2 (11-13-2012)

Certified Product: Module Rack Mounting System

License Fee - Units

Model Designation: SolarMount (SM)
with additional features and more qualified modules.

7

Max System Voltage of PV Module: 1000 VDC
Max Size of PV Module: 20.8 sq.ft. surface area
Max Overcurrent Protection Rating of PV Module:
30 A when using the qualified grounding lugs;
20 A when using the Enphase micro inverter EGC.

Fire Rating: Class A when installed with
Type 1, Type 2, Type3, or Type 10 fire rated modules.
(continued)

7

Appendix: 1,1-5

Licensed Test mark:



Date of Issue

(day/mo/yr)
06/11/2015

Certificate



Certificate no.

US 82140038 06

License Holder:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Manufacturing Plant:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Test report no.: USA-31440029 003

Client Reference: Tom Young

Tested to: Subject 2703 No. 2 (11-13-2012)

Certified Product: Module Rack Mounting System

License Fee - Units

(continued)

7

More Modules Evaluated & Qualified for Mechanical Load:

SunPower SPR-E20-327

Design Load: Positive = 112 psf, Negative = 50 psf

Hyundai Solar HiS-M300MI & HiS-S300MI

Design Load: Positive = 112 psf, Negative = 50 psf

Models from the same series with same frame are qualified
if their area is less than or equal to test module area.

(continued)

7

Appendix: 1,1-5

Licensed Test mark:



Date of Issue

(day/mo/yr)

06/11/2015

Certificate



Certificate no.

US 82140038 07

License Holder:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Manufacturing Plant:

Unirac Inc.
1411 Broadway NE
Albuquerque NM 87102
USA

Test report no.: USA- 31440029 003

Client Reference: Tom Young

Tested to: Subject 2703 No. 2 (11-13-2012)

Certified Product: Module Rack Mounting System

License Fee - Units

(continued)

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More Modules Evaluated & Qualified for Electrical Bonding:

Canadian Solar

ELPS CS6P-MM, ELPS CS6A-MM

Hyundai Heavy Industries

RG Series, RW Series

Panasonic

VBHNxxxSA06/SA06B/SA11/SA11B

SolarWorld

Sunmodule Pro

TSMC Solar

TS-150C2 CIGS

Appendix: 1,1-5

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Licensed Test mark:



Date of Issue

(day/mo/yr)

06/11/2015