

HISTORIC AND DESIGN REVIEW COMMISSION

January 20, 2016

Agenda Item No: 17

HDRC CASE NO: 2016-009
ADDRESS: 120 W SUMMIT
LEGAL DESCRIPTION: NCB 1767 BLK 1 LOT 4, W15 FT OF 5
ZONING: R4 H
CITY COUNCIL DIST.: 1
DISTRICT: Monte Vista Historic District
APPLICANT: Amber Hendon/APEX Home Energy Savings, LLC
OWNER: Scott & Allison Singleton
TYPE OF WORK: Solar Panel Installation
REQUEST:

The applicant is requesting a Certificate of Appropriateness for approval to install 12 solar panels at the rear roof of the main house and 16 panels on an outbuilding in the rear yard.

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:

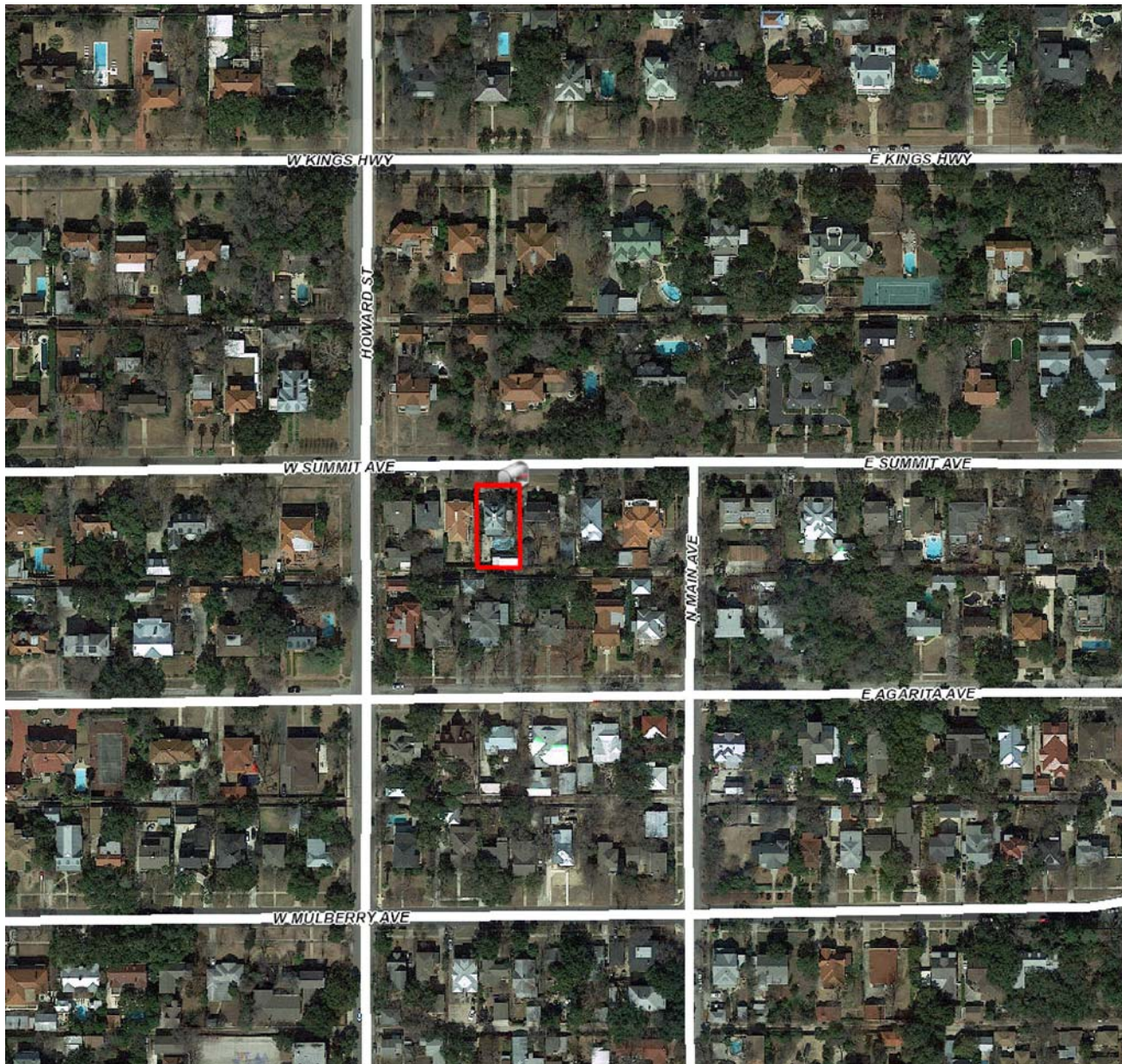
- a. According to the Guidelines for New Construction 7.C.i., solar collectors should be mounted on the side or rear roof pitch of the primary historic structure to minimize visibility from the public right-of-way while maximizing solar access. Alternatively, solar collectors should be mounted on a garage or outbuilding where solar access to the primary structure is limited. The applicant has proposed to locate the solar collectors on the rear roof of the primary structure and on the roof of a rear outbuilding. This is consistent with the Guidelines.

RECOMMENDATION:

Staff recommends approval based on finding a.

CASE MANAGER:

Katie Totman

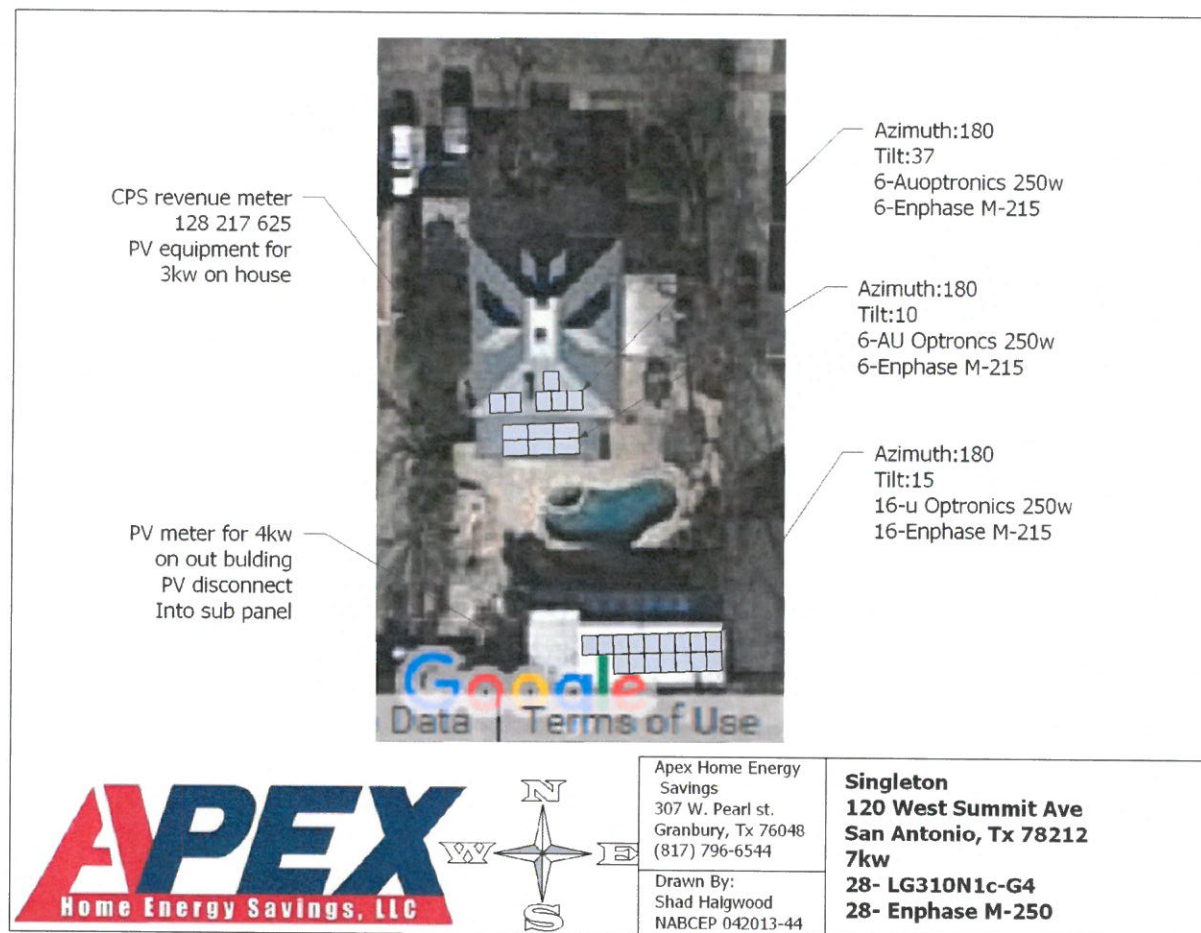


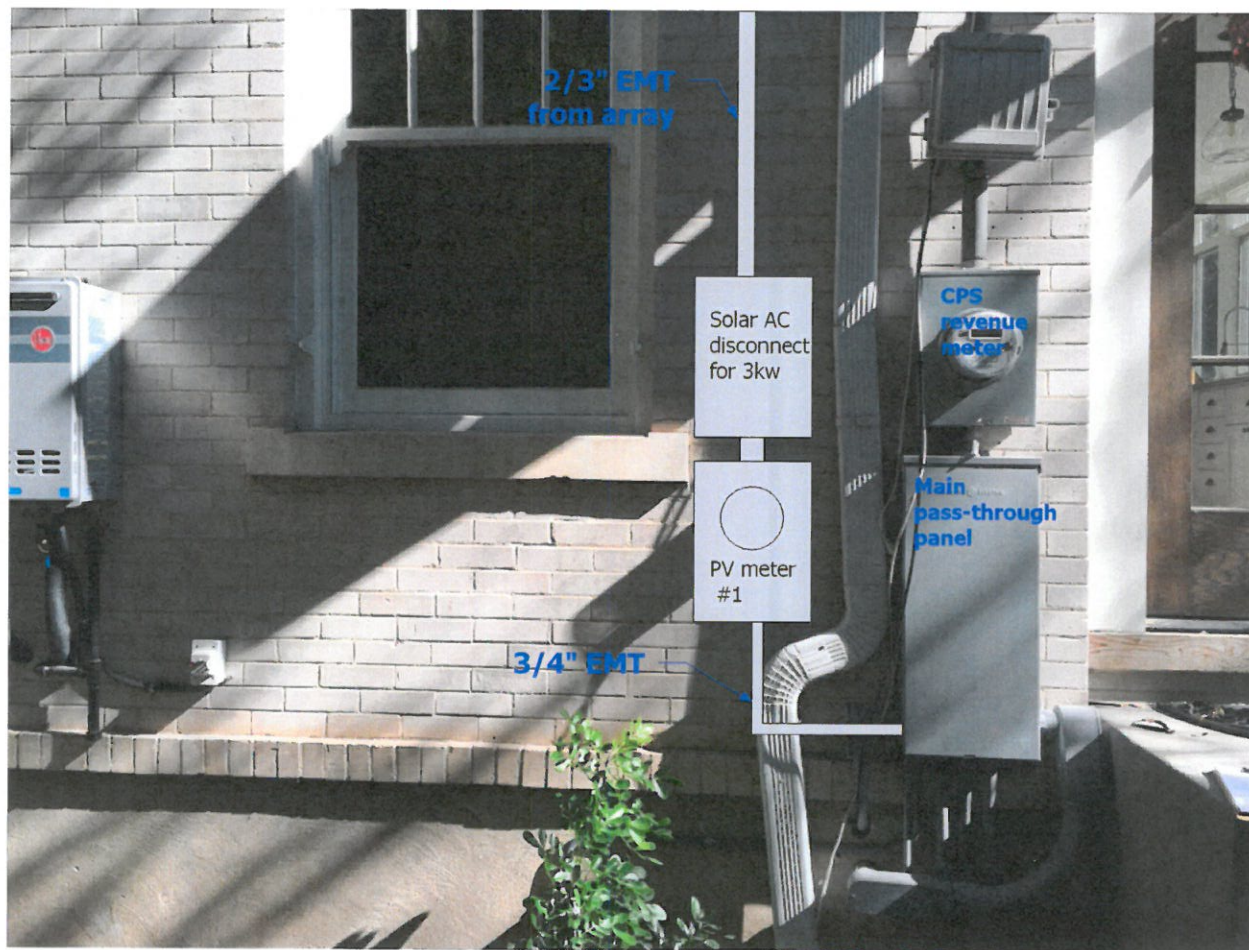
120 W Summit

Monte Vista

Printed: Jan 12, 2016

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2/3" EMT
from array

Solar AC
disconnect
for 3kw

PV meter
#1

CPS
revenue
meter

Main
pass-through
panel

3/4" EMT

NOTES FOR MICRO-INVERTER ELECTRICAL DIAGRAM

PV MODULE RATINGS @ STC (Guide Section 5)

MODULE MAKE	AU Optronics 250W
MODULE MODEL	PM 245p00_250
MAX POWER-POINT CURRENT (I_{MP})	8.17A
MAX POWER-POINT VOLTAGE (V_{MP})	30.6V
OPEN-CIRCUIT VOLTAGE (V_{OC})	37.4V
SHORT-CIRCUIT CURRENT (I_{SC})	8.69A
MAX SERIES FUSE (OCPD)	15A
MAXIMUM POWER (P_{MAX})	250W
MAX VOLTAGE (TYP 600V _{DC})	1000V
VOC TEMP COEFF (mV/°C □ or %/°C □)	-.32%/k
IF COEFF SUPPLIED, CIRCLE UNITS	

NOTES FOR ALL DRAWINGS:

OCPD = OVERCURRENT PROTECTION DEVICE

NATIONAL ELECTRICAL CODE® REFERENCES SHOWN AS (NEC XXX.XX)

INVERTER RATINGS (Guide Section 4)

INVERTER MAKE	Enphase
INVERTER MODEL	M-215
MAX DC VOLT RATING	48V
MAX POWER @ 40°C	225W
NOMINAL AC VOLTAGE	240V
MAX AC CURRENT	.9A
MAX OCPD RATING	20A

SIGNS—SEE GUIDE SECTION 7

SIGN FOR DC DISCONNECT

No sign necessary since 690.51 marking on PV module covers needed information

SIGN FOR INVERTER OCPD AND AC DISCONNECT (IF USED)

SOLAR PV SYSTEM AC POINT OF CONNECTION	
AC OUTPUT CURRENT	31.8A
NOMINAL AC VOLTAGE	240V
THIS PANEL FED BY MULTIPLE SOURCES (UTILITY AND SOLAR)	

NOTES FOR ARRAY CIRCUIT WIRING (Guide Section 6 and 8 and Appendix E):

- 1.) LOWEST EXPECT AMBIENT TEMPERATURE BASED ON ASHRAE MINIMUM MEAN EXTREME DRY BULB TEMPERATURE FOR ASHRAE LOCATION MOST SIMILAR TO INSTALLATION LOCATION. LOWEST EXPECTED AMBIENT TEMP 4 °C
- 2.) HIGHEST CONTINUOUS AMBIENT TEMPERATURE BASED ON ASHRAE HIGHEST MONTH 2% DRY BULB TEMPERATURE FOR ASHRAE LOCATION MOST SIMILAR TO INSTALLATION LOCATION. HIGHEST CONTINUOUS TEMPERATURE 39 °C
- 2.) 2009 ASHRAE FUNDAMENTALS 2% DESIGN TEMPERATURES DO NOT EXCEED 47°C IN THE UNITED STATES (PALM SPRINGS, CA IS 44.1°C). FOR LESS THAN 9 CURRENT-CARRYING CONDUCTORS IN ROOF-MOUNTED SUNLIT CONDUIT AT LEAST 0.5" ABOVE ROOF AND USING THE OUTDOOR DESIGN TEMPERATURE OF 47°C OR LESS (ALL OF UNITED STATES).
 - a) 12 AWG, 90°C CONDUCTORS ARE GENERALLY ACCEPTABLE FOR MODULES WITH I_{SC} OF 7.68 AMPS OR LESS WHEN PROTECTED BY A 12-AMP OR SMALLER FUSE.
 - b) 10 AWG, 90°C CONDUCTORS ARE GENERALLY ACCEPTABLE FOR MODULES WITH I_{SC} OF 9.6 AMPS OR LESS WHEN PROTECTED BY A 15-AMP OR SMALLER FUSE.

NOTES FOR INVERTER CIRCUITS (Guide Section 8 and 9):

- 1) IF UTILITY REQUIRES A VISIBLE-BREAK SWITCH, DOES THIS SWITCH MEET THE REQUIREMENT? YES ☒ NO ☐ N/A ☐
- 2) IF GENERATION METER REQUIRED, DOES THIS METER SOCKET MEET THE REQUIREMENT? YES ☒ NO ☐ N/A ☐
- 3) SIZE PHOTOVOLTAIC POWER SOURCE (DC) CONDUCTORS BASED ON MAX CURRENT ON NEC 690.53 SIGN OR OCPD RATING AT DISCONNECT
- 4) SIZE INVERTER OUTPUT CIRCUIT (AC) CONDUCTORS ACCORDING TO INVERTER OCPD AMPERE RATING. (See Guide Section 9)
- 5) TOTAL OF 2 INVERTER OUTPUT CIRCUIT OCPD(S). ONE FOR EACH MICRO-INVERTER CIRCUIT. DOES TOTAL SUPPLY BREAKERS COMPLY WITH 120% BUSBAR EXCEPTION IN 690.64(B)(2)(a)? YES ☒ NO ☐

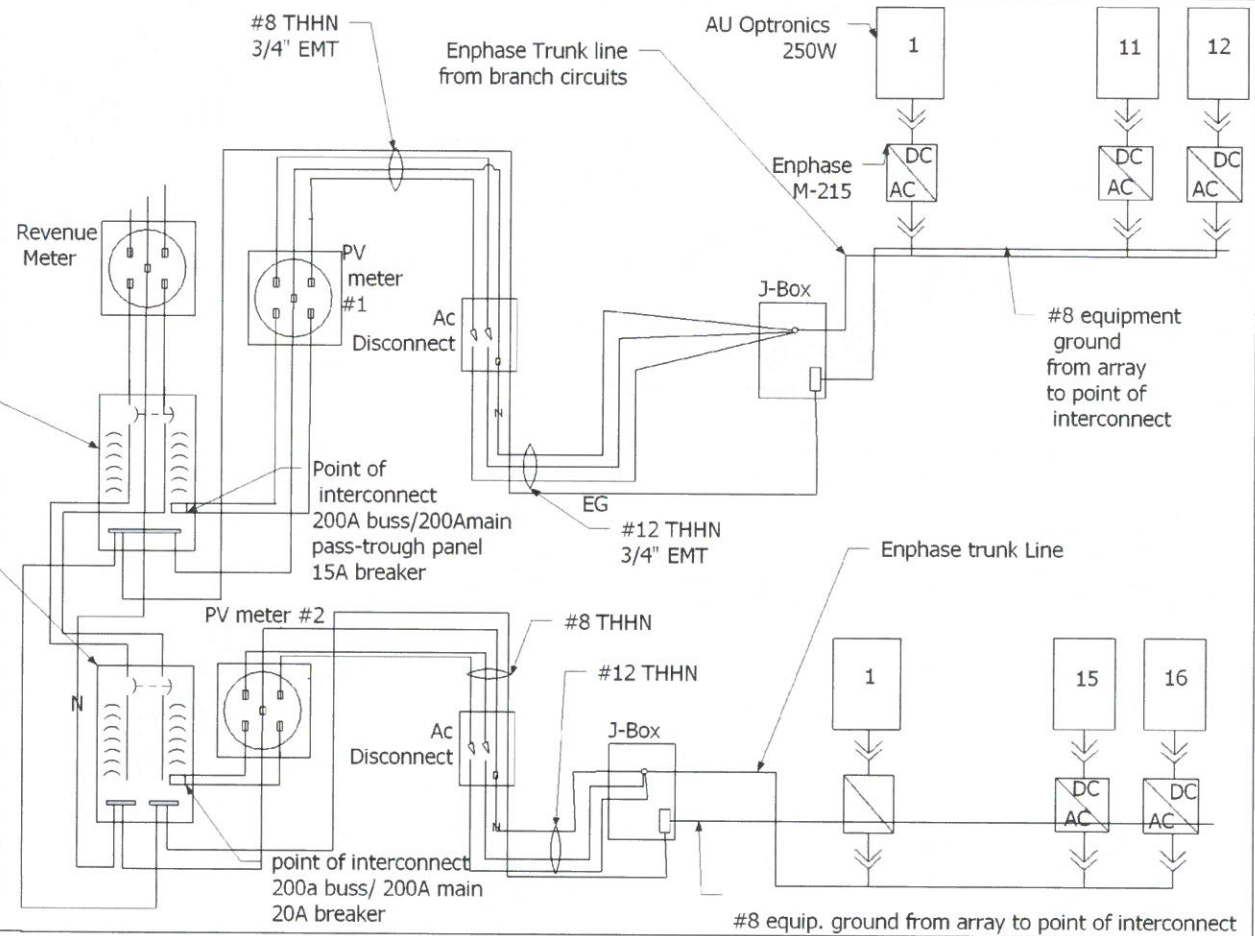
Contractor Name, Address and Phone: Apex Hoome Energy Savings 307 W. Pearl st. Granbury, Tx 76048 (817) 796-6544		Notes for One-Line Standard Electrical Diagram for Single-Phase PV Systems Site Name: Singleton Site Address: 120 W. Summit st., San Antonio, Tx 78212 System AC Size: 7kw	
Drawn By: Shad Haigwood	SIZE	FSCM NO	DWG NO
Checked By: NABCEP 042013-44	SCALE	NTS	Date: SHEET

Singleton
 7kw Enphase
 120 W. Summit st., San Antonio,Tx
 28-Au Optronics 250W
 28-Enphase M-215 Micro Inverters
 1- Branch circuit of 12/13A
 to main pass-through panel
 1- Branch circuit of 16/17.7A
 to subpanel on outbuilding
 31A total@ 240v Full system

Main panel at house

Existing sub panel at out building

Apex Home Energy Savings
 307 W. Pearl st.
 Granbury,Tx 76048
 (817)796-6544
 Drawn By: Shad Haigwood
 NABCEP 042013-44





3/4" EMT from array

PV meter #2
for 4kw on out-building

from back of meter
wire to inside sub panel

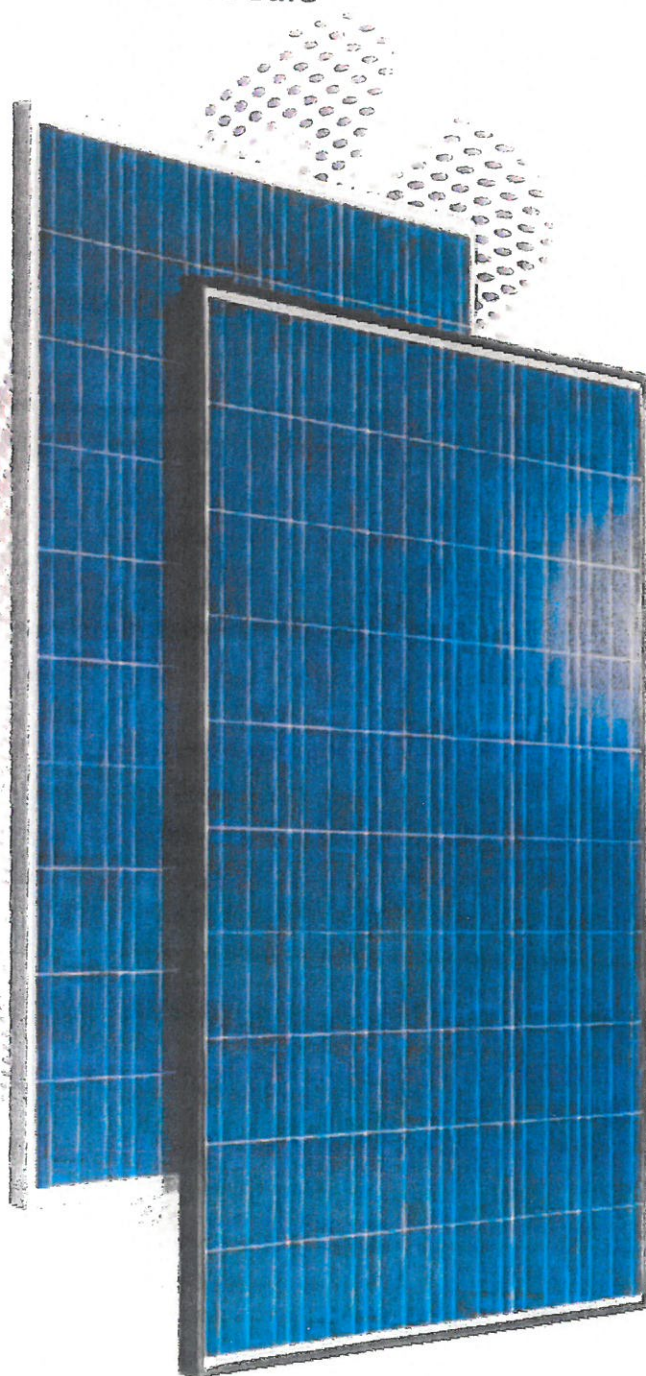
Solar AC disconnect
for 4kw on out-building





Green Triplex PM245P00

Multi-Crystalline
Photovoltaic Module



240W
260W

Power Range
240 ~ 260 Wp



Highly Strengthened Design

Module complies with advanced loading tests to meet 5400 Pa loading requirements



IP-67 Rated Junction Box

Advanced water and dust proof level



Flammability Test

Low ignitability ensuring fire safety



Anti-Reflection Coated Glass

Anti-reflective surface enhances the power performance



PID-Free



Resistance to Salt Corrosion and Humidity

Module complies with IEC 61701: Salt Mist Corrosion Testing



Ammonia Test

Reliable in ammonia rich environment



BenQ
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Green Triplex PM245P00 (240 ~ 260 W_p)

Electrical Data

Typ. Nominal Power P _N	240 W	245 W	250 W	255 W	260 W
Typ. Module Efficiency	14.9%	15.2%	15.5%	15.8%	16.1%
Typ. Nominal Voltage V _{mp} (V)	29.9	30.3	30.6	30.8	31.2
Typ. Nominal Current I _{mp} (A)	8.03	8.09	8.17	8.28	8.34
Typ. Open Circuit Voltage V _{oc} (V)	37.0	37.2	37.4	37.6	37.7
Typ. Short Circuit Current I _{sc} (A)	8.58	8.64	8.69	8.76	8.83
Maximum Tolerance of P _N	0 / +3%				

• Above data are the effective measurement at Standard Test Conditions (STC).
 • STC: irradiance 1000 W/m², spectral distribution AM 1.5, temperature 25 ± 2 °C, in accordance with EN 60904-3.
 • The given electrical data are nominal values which account for basic measurements and manufacturing tolerances of ±10%, with the exception of P_N. The classification is performed according to P_N.

Temperature Coefficient

NOCT	46 ± 2 °C
Typ. Temperature Coefficient of P _N	-0.44 % / K
Typ. Temperature Coefficient of V _{oc}	-0.32 % / K
Temperature Coefficient of I _{sc}	0.04 % / K

• NOCT: Normal Operation Cell Temperature, measuring conditions: irradiance 800 W/m², AM 1.5, air temperature 20 °C, wind speed 1 m/s

Mechanical Characteristics

Dimensions (L x W x H)	1639 x 983 x 40 mm (64.53 x 38.70 x 1.57 in)
Weight	18.5 kg (40.79 lbs)
Front Glass	High transparent solar glass (tempered), 3.2 mm (0.13 in)
Cell	60 multicrystalline solar cells, 156 x 156 mm (6 x 6 in)
Cell Encapsulation	EVA
Back Sheet	Composite film
Frame	Anodized aluminum frame
Junction Box	IP-67 rated with 3 bypass diodes
Connector Type & Cables	TE Connectivity PV4: 1 x 4 mm ² (0.04 x 0.16 in ²), Length: each 1.0 m (39.37 in) YUKITA YS-254/YS-255: 1 x 4 mm ² (0.04 x 0.16 in ²), Length: each 1.065 m (41.93 in)

Operating Conditions

Operating Temperature	-40 ~ +85 °C
Ambient Temperature Range	-40 ~ +45 °C
Max. System Voltage IEC/UL	1000 V / 1000 V
Serial Fuse Rating	15 A
Maximum Surface Load Capacity	Tested up to 5400 Pa according to IEC 61215 (advanced test)

Warranties and Certifications

Product Warranty	Maximum 10 years for material and workmanship
Performance Guarantee	Guaranteed linear degradation to 80% for 25 years *1
Certifications	According to IEC/EN 61215, IEC/EN 61730 and UL 1703 guidelines *2

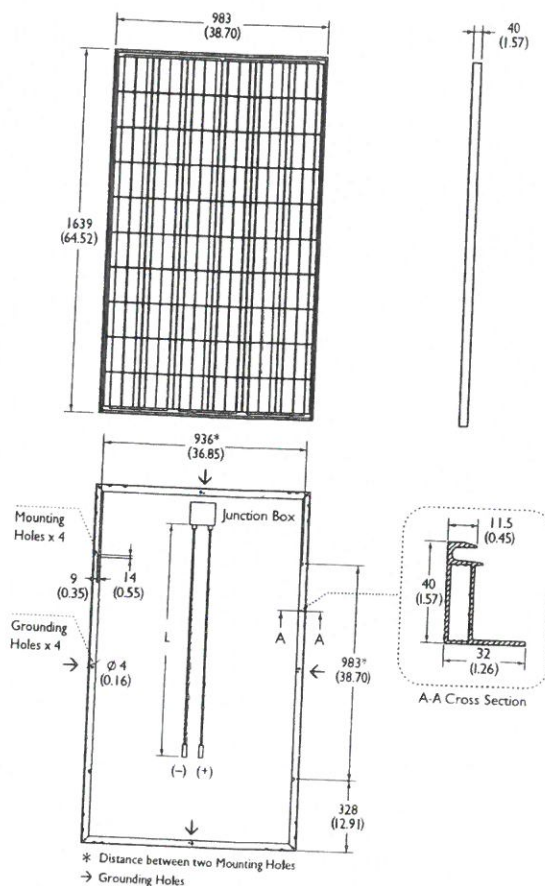
*1: Please refer to warranty letter for detail

*2: Please confirm other certifications with official dealers

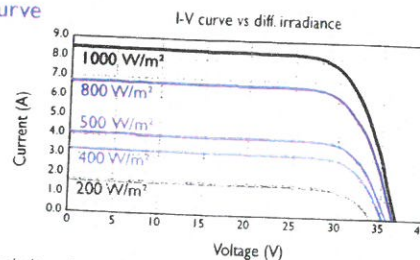
Packing Configuration

Container	20' GP	40' GP	40' HQ
Pieces per Pallet	26	26	26
Pallets per Container	6	14	28
Pieces per Container	156	364	728

Dimensions mm (inch)



I-V Curve



Current/voltage characteristics with dependence on irradiance and module temperature.

Dealer Stamp



AU Optonics Corporation

No. 1, Li-Hsin Rd. 2, Hsinchu Science Park, Hsinchu 30078, Taiwan
 Tel: +886-3-500-8899 www.BenQSolar.com



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Warranty and Performance Guarantee Conditions of BenQ Solar PV module

BenQ Solar limited warranty for photovoltaic modules:

PM200M00, PM220P00, PM240P00, PM250M00, PM250M01, PM318B00, PM318B01, PM245P00, PM300P00

Attention to :

I. Warranty

1. AU Optronics Corporation, No.1, JhongKe Rd., Central Taiwan Science Park, Taichung 40763, Taiwan, R.O.C. ("AUO") warrants that the photovoltaic modules with model number as specified as above ("module(s)") shall be free from defects in materials and workmanship under normal use conditions (see section III.) for a term of ten (10) years starting from the end of the first six (6) months after the manufacturing date of the respective modules.
2. Defects which are recognizable at the time of delivery must be reported to AUO in written form. Defects which appear later or unknowable defects shall be reported to AUO in writing within seven days from actual knowledge of the relevant defect.
3. Should a module not be free of defect, AUO will correct the defect free of charge or replace the defective module free of charge. In the event that such correction of the relevant defect or the replacement fails to cure the relevant defect, the customer may, at AUO's sole option, require (i) a further correction of the relevant defect, or (ii) a replacement of the defective module by providing compatible model, or (iii) a refund of the value of the defective module based on a mutually agreed price.
4. Each notice relating to a defective module shall be accompanied by the necessary information requested by AUO. The return of modules to AUO is allowed only after written consent from AUO.

II. Performance guarantee

1. With respect to modules of BenQ Solar limited warranty PV module, AUO guarantees that within a term of ten (10) years from the module manufacturing date in AUO, the performance of a module will not be below 90% of the minimum performance standards of the module as stated in the relevant data sheet, and within a term of twenty-five (25) years from the module manufacturing date in AUO, the performance of a module will not be below 80% of the minimum performance standards of the module as stated in the relevant data sheet.
2. Should the actual performance of the modules be below the parameters stated in section II.1 and should this defect be proven by the customer by evidencing the certified report through a generally accepted test procedure of an IECCE accredited PV-testing laboratory, AUO will compensate for the loss of performance in power, at AUO's sole option, by (i) delivering additional modules of compatible model to make up such loss in power, or (ii) providing monetary compensation equivalent to the cost of additional PV modules required to make up such loss in power or (iii) by repairing or replacing a defective module.
3. In the event of a replacement delivery made by AUO, the customer is not entitled to receive new photovoltaic modules. AUO is authorized to also supply used or repaired photovoltaic modules.
4. The replacement of modules or the delivery of additional modules shall not renew or extend the warranty period stated in section I.1 or the term of the performance guarantee stated in section II.1.
5. Claims under this Warranty and Performance Guarantee must be made according to the conditions herein and must be sent to AUO in writing within seven days from the date on which the defect is recognized.

III. Normal conditions of use

1. The warranties as set out under section I. can only be granted if the modules manufactured by AUO have been



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installed and used in a proper and orderly fashion.

2. Warranty claims must in any event be notified to AUO within the applicable warranty period.

3. Exclusions

- A. operation under unsuitable environmental conditions or using unsuitable methods which deviate from the product specifications, operating instructions, installation guide or rating plate data;
- B. alteration, disassembly, reinstallation, and/or improper installation by persons not authorized or qualified by AUO;
- C. extreme external influences such as smoke, salt, acid rain or other pollutants or persons (vandalism);
- D. installation on mobile device or marine environment, such as vehicles, ships etc.; direct contact with corrosive agents, salt water, acid rain, pest damage or other pollution;
- E. any other improper usage, e.g., for another purpose or use other than such provided for and in a manner which does not correspond to the technical or safety regulations applicable in the country in which the module is being operated;
- F. caused by forces of nature, force majeure and other unforeseeable circumstances outside the range of influence of AUO such as e.g. earthquakes, typhoons, cyclones, volcano eruptions, floods, lightning, snow damages, power outage, surge voltage, or mold discoloration, or other events beyond AUO control including but not limited to any physical or technological event or condition;
- G. PV module label has been removed, altered or made illegible;
- H. if modules are coupled or interconnected with other incompatible modules, types or parts;
- I. naturally occurring scratches, stains, rust, discoloring, or other alteration occurring after the shipment from AUO that have no effect on the power generation performance or mechanical strength of the module.

IV. Limitation of the guarantee of performance

The warranties stated in section I. or the performance guarantee stated in section II. shall not form the basis for further claims against AUO, in particular for compensation due to lost profits, compensation for loss of use, indirect damages or claims for compensation of damages which may occur beyond the product.

The warranties and guarantees made aforesaid is exclusive and stated in lieu of all other warranties, whether express, statutory or implied, including but not limited to the warranties of merchantability and fitness for a particular purpose, all of which are hereby expressly disclaimed.

V. Applicable Law

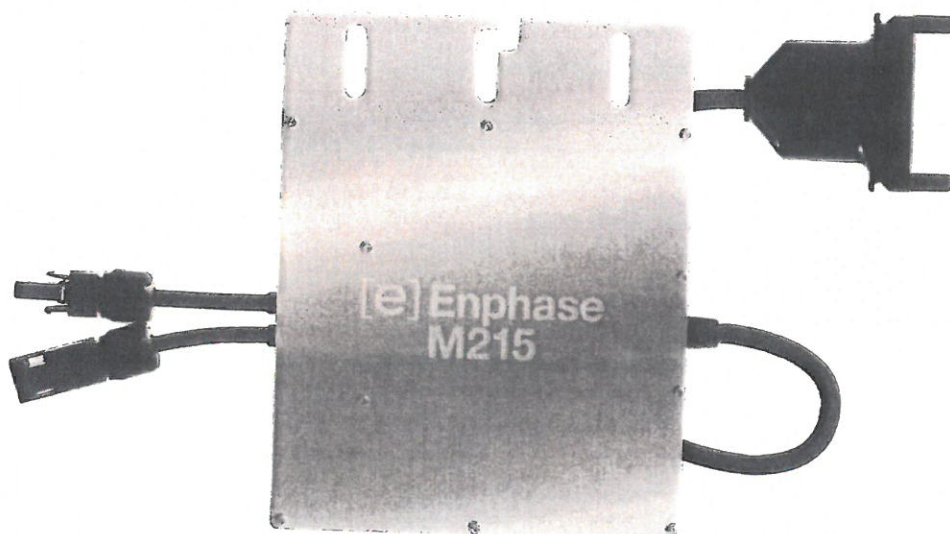
These guarantee terms shall be governed by the laws of Germany excluding the Convention on Contracts of International Sale of Goods and any conflicts of laws provisions.

VI. Validity

These Warranty and Performance Guarantee Conditions apply to modules manufactured by AUO and delivered from July 1st, 2012

Enphase® Microinverters

Enphase® M215



The **Enphase® M215 Microinverter** with integrated ground delivers increased energy harvest and reduces design and installation complexity with its all-AC approach. With the advanced M215, the DC circuit is isolated and insulated from ground, so **no Ground Electrode Conductor (GEC) is required for the microinverter**. This further simplifies installation, enhances safety, and saves on labor and materials costs.

The Enphase M215 integrates seamlessly with the Engage® Cable, the Envoy® Communications Gateway™, and Enlighten®, Enphase's monitoring and analysis software.

PRODUCTIVE

- Maximizes energy production
- Minimizes impact of shading, dust, and debris
- No single point of system failure

SIMPLE

- No GEC needed for microinverter
- No DC design or string calculation required
- Easy installation with Engage Cable

RELIABLE

- More than 1 million hours of testing and millions of units shipped
- Industry-leading warranty, up to 25 years

Enphase® M215 Microinverter // DATA

INPUT DATA (DC)

	M215-60-2LL-S22-IG / S23-IG / S24-IG
Recommended input power (STC)	190 - 270 W
Maximum input DC voltage	48 V
Peak power tracking voltage	27 V - 39 V
Operating range	16 V - 48 V
Min/Max start voltage	22 V / 48 V
Max DC short circuit current	15 A

OUTPUT DATA (AC)

	@208 VAC	@240 VAC
Peak output power	225 W	225 W
Rated (continuous) output power	215 W	215 W
Nominal output current	1.03 A (A rms at nominal duration)	0.9 A (A rms at nominal duration)
Nominal voltage/range	208 V / 183-229 V	240 V / 211-264 V
Nominal frequency/range	60.0 / 57-61 Hz	60.0 / 57-61 Hz
Extended frequency range*	57-62.5 Hz	57-62.5 Hz
Power factor	>0.95	>0.95
Maximum units per 20 A branch circuit	25 (three phase)	17 (single phase)
Maximum output fault current	850 mA rms for 6 cycles	850 mA rms for 6 cycles

EFFICIENCY

CEC weighted efficiency, 240 VAC	96.5%
CEC weighted efficiency, 208 VAC	96.5%
Peak inverter efficiency	96.5%
Static MPPT efficiency (weighted, reference EN50530)	99.4 %
Night time power consumption	65 mW max

MECHANICAL DATA

Ambient temperature range	-40°C to +65°C
Dimensions (WxHxD)	171 mm x 173 mm x 30 mm (without mounting bracket)
Weight	1.6 kg (3.4 lbs)
Cooling	Natural convection - No fans
Enclosure environmental rating	Outdoor - NEMA 6

FEATURES

Compatibility	Compatible with 60-cell PV modules.
Communication	Power line
Integrated ground	The DC circuit meets the requirements for ungrounded PV arrays in NEC 690.35. Equipment ground is provided in the Engage Cable. No additional GEC or ground is required. Ground fault protection (GFP) is integrated into the microinverter.
Monitoring	Enlighten Manager and MyEnlighten monitoring options
Compliance	UL1741/IEEE1547, FCC Part 15 Class B, CAN/CSA-C22.2 NO. 0-M91, 0.4-04, and 107.1-01

* Frequency ranges can be extended beyond nominal if required by the utility

To learn more about Enphase Microinverter technology,
visit enphase.com



Enphase Energy M215 Microinverter 25-Year Limited Warranty - North America

Enphase Energy Inc. ("Enphase") has developed a highly reliable microinverter, designated as the M215 Series ("Microinverter"), that is designed to withstand normal operating conditions when used for its originally intended purpose in compliance with the Enphase User Manual made available with the originally shipped system. The Enphase limited warranty ("Limited Warranty") covers defects in workmanship and materials of the Enphase Microinverter ("Defective Product") for a period of twenty-five (25) years from the date of original purchase of such Microinverter at point of sale to the system owner (the "Warranty Holder") at the originally-installed end user location (the "Warranty Period") in locations where we have approved our Microinverters for installation as listed on our website at <http://www.enphase.com/warranty>.

During the Warranty Period, the Limited Warranty is transferable to a different owner ("Transferee") as long as the Microinverter remains installed at the originally-installed end user location ("Original Location") and the Transferee submits to Enphase a "Change of PV Ownership Form" and applicable Transfer Fee within 30 days from the date of transfer to the Transferee. This submission is a requirement for continued Limited Warranty coverage. The Transfer Fee is set forth in the Change of PV Ownership Form, and is subject to reasonable adjustment from time to time (as determined at Enphase's discretion). The Change of PV Ownership Form and payment instructions are available at <http://www.enphase.com/warranty>. Enphase reserves the right to provide separate warranties that shall govern with respect to Microinverters installed in specific regions as set forth on our website at <http://www.enphase.com/warranty>.

During the Warranty Period, if Enphase establishes, through inspection, the existence of a defect that is covered by the Limited Warranty, Enphase will at its option, either (1) repair or replace the Defective Product free of charge, or (2) issue a credit or refund for the Defective Product to the Warranty holder in an amount up to its actual value at the time the Warranty Holder notifies Enphase of the defect, as determined by Enphase.

If Enphase elects to repair or replace the Defective Product, Enphase will, at its option, use new and/or reconditioned parts in repairing or replacing the Defective Product. Enphase reserves the right to use parts or products of original or improved design in the repair or replacement of Defective Product. If Enphase repairs or replaces a Defective Product, the Limited Warranty continues on the repaired or replacement product for the remainder of the original Warranty Period or ninety (90) days from the date of Enphase's return shipment of the repaired or replacement product, whichever is later. The Limited Warranty covers a replacement unit to replace the Defective Product, but does not include labor costs related to (1) un-installing the Defective Product or (2) if applicable, re-installing a repaired or replacement product. To the extent applicable, the Limited Warranty also covers the costs of shipping a repaired or replacement product from Enphase, via a non-expedited freight carrier selected by Enphase, to locations in North America where we have approved our Microinverters for installation as listed on our website at <http://www.enphase.com/warranty>. The Limited Warranty does not cover, and Enphase will not be responsible for, shipping damage or damage caused by mishandling by the freight carrier and any such damage is the responsibility of the freight carrier.

Enphase Microinverters are designed to withstand normal operating conditions and typical wear and tear when used for their original intent and in compliance with the installation and operating instructions supplied with the original equipment. The Limited Warranty does not apply to, and Enphase will not be responsible for, any defect in or damage to any Enphase Microinverter: (1) that has been misused, neglected, tampered with, altered, or otherwise damaged, either internally or externally; (2) that has been improperly installed, operated, handled or used, including use under conditions for which the product was not designed, use in an unsuitable environment, or use in a manner contrary to the Enphase User Manual

or applicable laws or regulations; (3) that has been subjected to fire, water, generalized corrosion, biological infestations, acts of God, or input voltage that creates operating conditions beyond the maximum or minimum limits listed in the Enphase Microinverter specifications, including high input voltage from generators or lightning strikes; (4) that has been subjected to incidental or consequential damage caused by defects of other components of the solar system; or (5) if the original identification markings (including trademark or serial number) of such Microinverter have been defaced, altered, or removed. This Limited Warranty does not cover cosmetic, technical or design defects, or shortcomings which do not materially influence or affect the energy production or degrade form, fit, or function of the Enphase Microinverter. The Limited Warranty does not cover costs related to the removal, installation or troubleshooting of the Warranty Holder's electrical systems. The Limited Warranty does not extend beyond the original cost of the Enphase Microinverter.

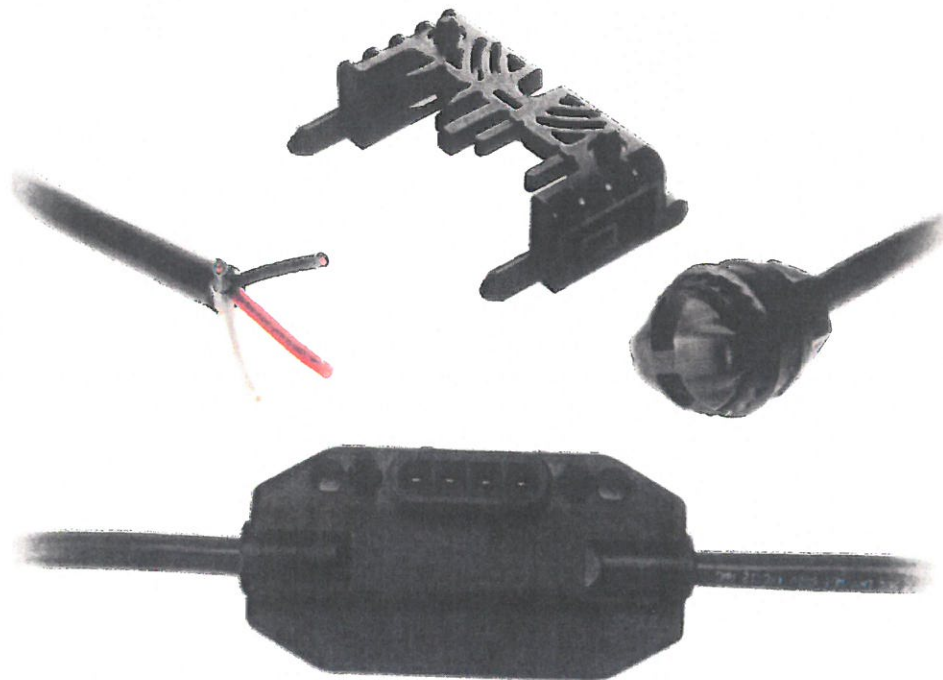
To obtain repair or replacement service, credit or refund (as applicable) under this Limited Warranty, the Warranty Holder must comply with the Return Merchandise Authorization Number (RMA) policy and procedure <http://www.enphase.com/rma>.

Enphase expressly reserves the right to novate or assign its rights and obligations under this warranty agreement to a third party with the demonstrated expertise and requisite resources needed to effectively discharge the obligations hereunder.

THE LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY GIVEN BY ENPHASE AND, WHERE PERMITTED BY LAW, IS MADE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF TITLE, QUALITY, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OR WARRANTIES AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN MANUALS OR OTHER DOCUMENTATION. IN NO EVENT WILL ENPHASE BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, COSTS OR EXPENSES HOWEVER ARISING, WHETHER IN CONTRACT OR TORT, INCLUDING WITHOUT LIMITATION ANY ECONOMIC LOSSES OF ANY KIND, ANY LOSS OR DAMAGE TO PROPERTY, OR ANY PERSONAL INJURY.

To the extent any implied warranties are required under applicable law to apply to the Enphase Microinverter, such implied warranties shall be limited in duration to the Warranty Period, to the extent permitted by applicable law. Some regions do not allow limitations or exclusions on implied warranties or on the duration of an implied warranty or on the limitation or exclusion of incidental or consequential damages, so the above limitation(s) or exclusion(s) may not apply. This Limited Warranty gives the Warranty Holder specific legal rights, and the Warranty Holder may have other rights that may vary from region to region. The grant of this Limited Warranty by Enphase is conditioned upon agreement by the Warranty Holder and any permitted Transferee to the terms, conditions and requirements herein.

Enphase® Engage Cable



The **Engage™ Cable** is a continuous length of 12AWG cable with pre-installed connectors for Enphase Microinverters. The cable is handled like standard outdoor-rated electrical wire, allowing it to be cut, spliced and extended as needed.

The **Engage Accessories** complement the Engage Cable and give it the ability to adapt to any installation.

FAST

- Quick installation
- Large branch capacity

FLEXIBLE

- Simple design
- No additional cables

SAFE

- No high voltage DC
- Reduced fire risk

CABLE TYPES / ORDERING OPTIONS

Voltage	Connector Spacing	PV Module Orientation	Model Number	#Connectors*	Weight**
240 VAC, 4 conductors	1.025 meter (40")	Portrait	ET10-240-40	40	40 lbs
240 VAC, 4 conductors	1.7 meter (67")	Landscape	ET17-240-40	40	45 lbs
208 VAC, 5 conductors	1.025 meter (40")	Portrait	ET10-208-30	30	30 lbs
208 VAC, 5 conductors	1.7 meter (67")	Landscape	ET17-208-30	30	35 lbs

*additional lengths available through Enphase authorized distributors. **weights are approximate

CABLE SPECIFICATIONS

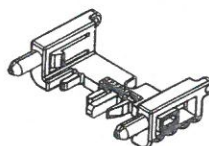
Description	Rating
Cable temperature rating	90°C (194°F) wet/dry
Cable insulator rating	THWN-2
UV exposure rating	UL 746 C, F1
Conductor size	12 AWG
Compliance	IEC 60529 IP67, CAN/CSA 22.2 No. 21, 182.3, UL 486A/B, 514C, 6703, and 9703
Cable rating	TC-ER
Cable Diameter	240 VAC: 10.75mm (0.425") 208 VAC: 11.75mm (0.463")
Minimum bend radius	12 cm (4.75")

ENGAGE ACCESSORIES



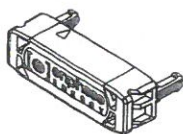
Branch Terminator

One terminator needed per branch circuit
ET-TERM-10 (sold in packs of 10)



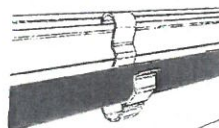
Disconnect Tool

Plan to use at least one per installation
ET-DISC-05 (sold in packs of 5)



Watertight Sealing Cap

One needed to cover each unused connector on the cabling
ET-SEAL-10 (sold in packs of 10)



Cable Clip

Many needed to fasten cabling to the racking or to secure looped cabling
ET-CLIP-100 (sold in packs of 100)



Engage Coupler

Used for splicing two power cables within an array
ET-SPLK-05 (sold in packs of 5)

To learn more about Enphase Microinverter technology, visit enphase.com

SERIES 100 UL FLASHED L FOOT KIT

SnapNrack Solar Mounting Solutions

The SnapNrack line of solar mounting solutions is designed to reduce total installation costs. The system's technical innovations have been proven to drive down costs and improve installation quality on more than 350 MW of solar installations.

Flashed L Foot Simplified

SnapNrack Series 100 Flashed L Foot Kit is an innovative solution to provide a long lasting watertight seal over the life of the system. The Flashed L Foot provides a fully flashed roof fastener for attachment to composition roof with no required cutting of shingles. The L Foot is engineered for maximum adjustability for a clean level installation.

- 1" slotted bolt connection
- 1" spacers available for increased adjustability
- Clear or Black anodized aluminum components (both available with black flashing)
- No Cutting of shingles



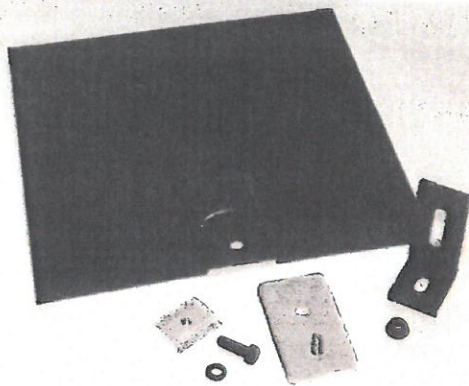
Flashed L Foot in 4 Simple Steps:

- 1) Locate a rafter in the roof using a pilot drill
- 2) Install base to the roof on top of the composition shingle
- 3) Use a breaker bar to separate the composition shingles above the base, and install the flashing
- 4) Attach the L foot on top and proceed with rail installation and leveling

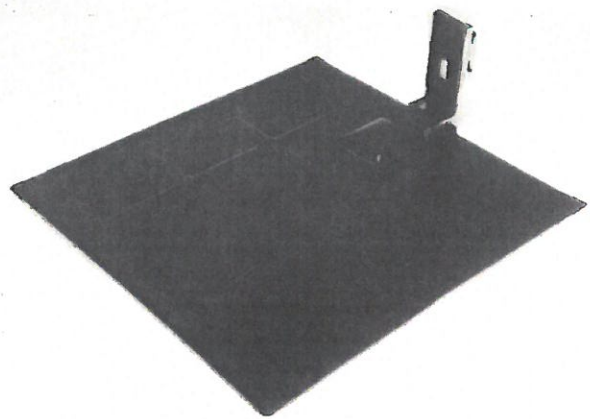
Place order with your distributor. Purchase material for a single project or order in bulk for additional savings

Patent Pending



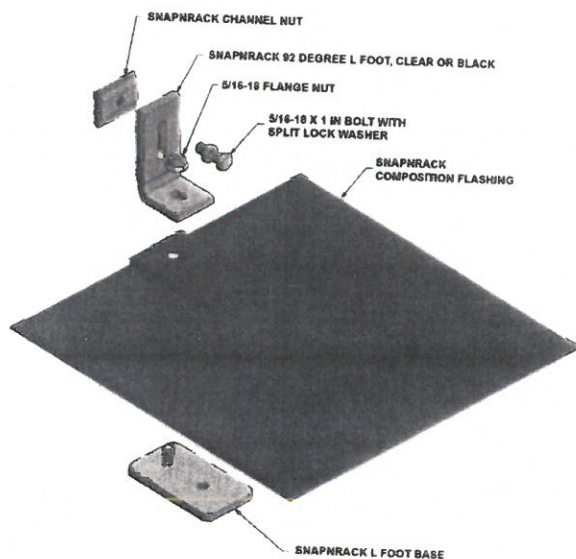


Flashed L Foot Kit Parts

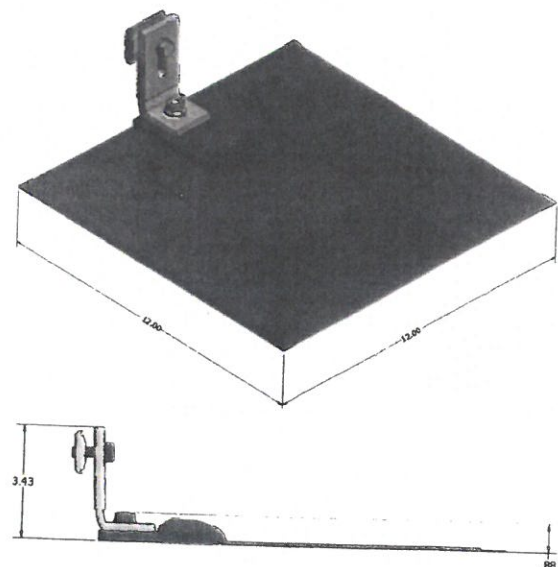


Flashed L Foot Kit Assembled

Flashed L Foot Kit Assembly



Flashed L Foot Kit Dimensions



SnapNrack Flashed L Foot Technical Data <small>Patent Pending</small>	
Materials	<ul style="list-style-type: none"> 6000 Series Aluminum L Foot & Base Stainless Steel Hardware Galvanized Steel Flashing w/ black all weather coating
Material Finish	<ul style="list-style-type: none"> Clear and black anodized aluminum
Weight	<ul style="list-style-type: none"> 1.3 lbs
Design Uplift Load	<ul style="list-style-type: none"> 350 lbs Uplift
Design Ultimate Load	<ul style="list-style-type: none"> 1,000 lbs Uplift
Warranty	<ul style="list-style-type: none"> 10 Year material and workmanship

SnapNrack™
Solar Mounting Solutions

(877) 732-2860 www.SnapNrack.com

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SOLARMOUNT™

Top Mounting UniRac Grounding Clips and WEEBLugs - 225.6

UGC-1

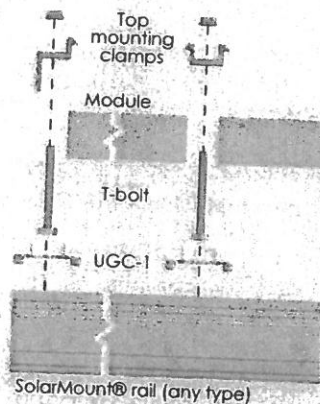
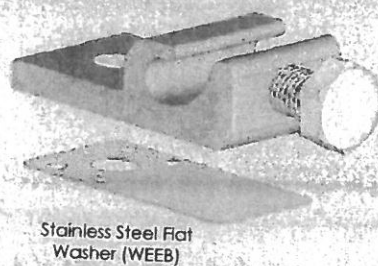


Figure 26. Slide UGC-1 grounding clip into top mounting slot of rail. Torque modules in place on top of clip. Nibs will penetrate rail anodization and create grounding path through rail (see Fig. 3, reverse side).

WEEBLug



Clips and lugs are sold separately.

Figure 27. Insert a bolt in the aluminum rail or through the clearance hole in the stainless steel flat washer. Place the stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Place the lug portion on the bolt and stainless steel flat washer. Install stainless steel flat washer, lock washer and nut. Tighten the nut until the dimples are completely embedded into the rail and lug. The embedded dimples make a gas-tight mechanical connection and ensure good electrical connection between the aluminum rail and the lug through the WEEB.

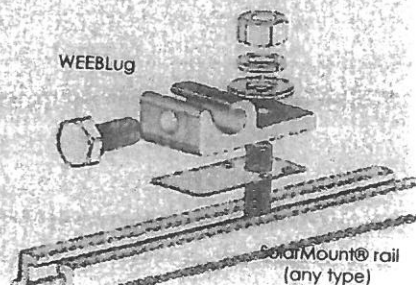
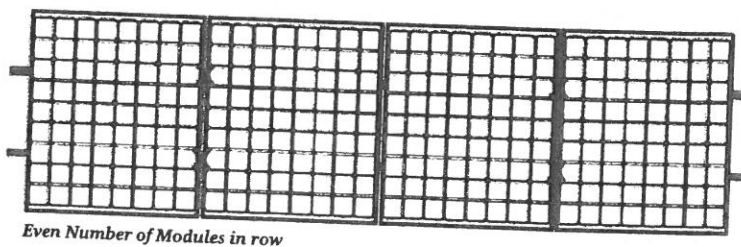
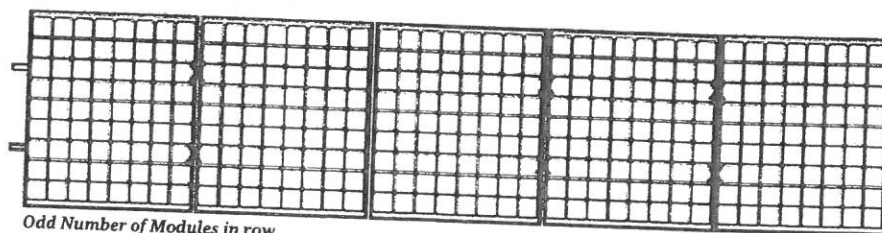


Figure 28. UGC-1 layout for even and odd number of modules in row. "X" denotes places to install UGC-1.



Even Number of Modules in row



Odd Number of Modules in row

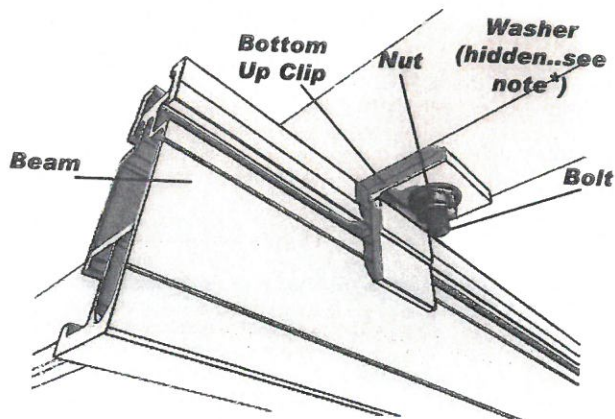
SOLARMOUNT Technical Datasheet

Pub 130817

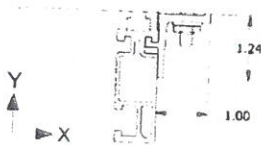
SOLARMOUNT Module Connection Hardware	1
Bottom Up Module Clip.....	1
Mid Clamp	2
End Clamp.....	2
SOLARMOUNT Beam Connection Hardware	3
L-Foot.....	3
SOLARMOUNT Beams	4

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 1/4"-20 ASTM F593 bolt, one 1/4"-20 ASTM F594 serrated flange nut, and one 1/4" 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



Dimensions specified in inches unless noted

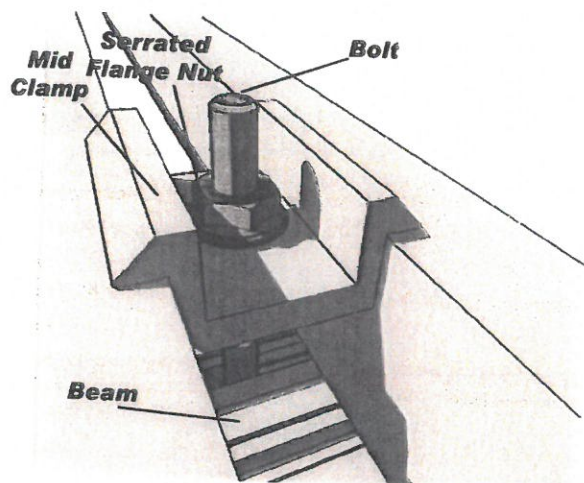
Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, Φ
Tension, Y+	1566 (6967)	686 (3052)	2.28	1038 (4615)	0.662
Transverse, X±	1128 (5019)	329 (1463)	3.43	497 (2213)	0.441
Sliding, Z±	66 (292)	27 (119)	2.44	41 (181)	0.619

SOLARMOUNT Technical Datasheets

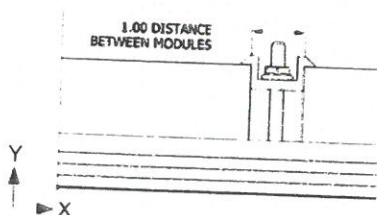


SOLARMOUNT Mid Clamp

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

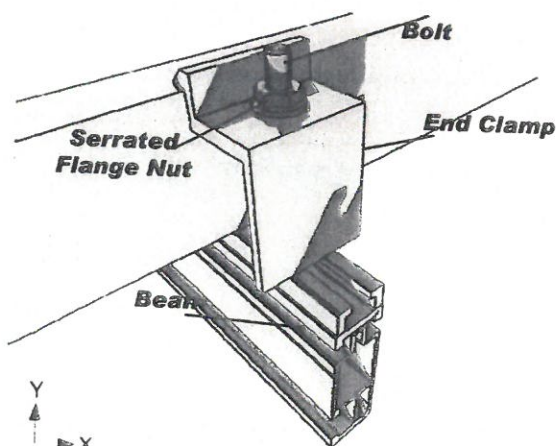


Dimensions specified in inches unless noted

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



HEIGHT VARIES WITH MODULE THICKNESS

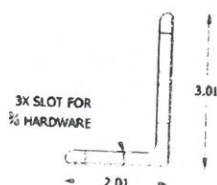
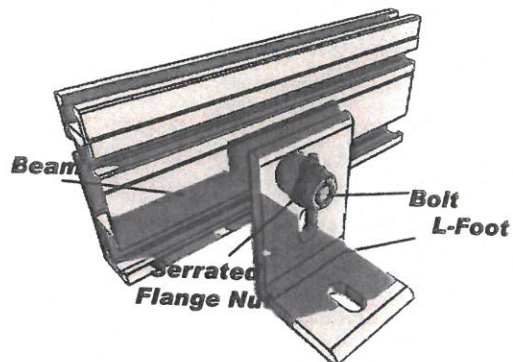
Dimensions specified in inches unless noted

- **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 3/8"-16 hex head screw and one ASTM F594 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

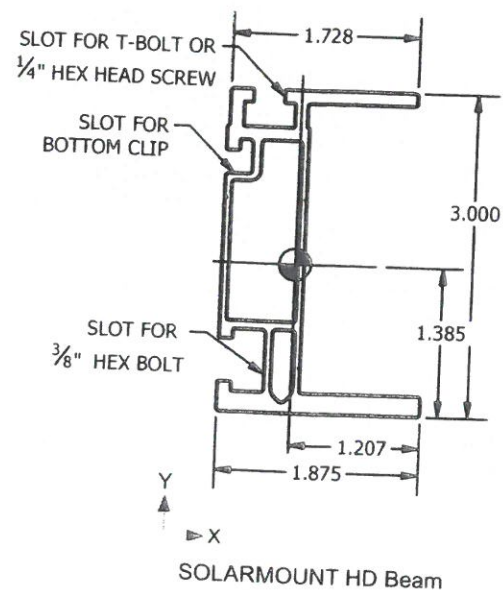
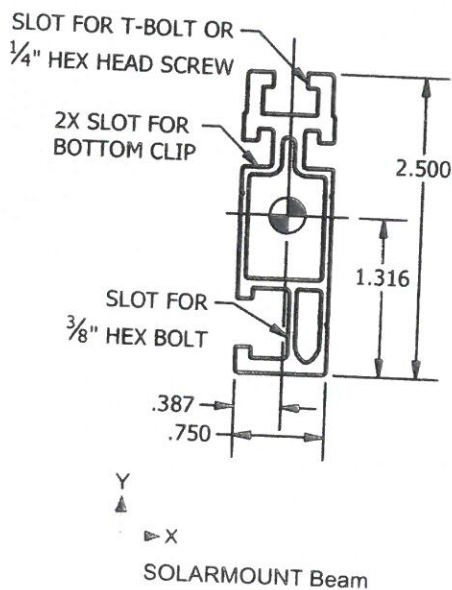
Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, Φ
Sliding, Z \pm	1766 (7856)	755 (3356)	2.34	1141 (5077)	0.646
Tension, Y+	1859 (8269)	707 (3144)	2.63	1069 (4755)	0.575
Compression, Y-	3258 (14492)	1325 (5893)	2.46	2004 (8913)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