

ELECTRICAL PERMIT

City of Portland, Me.



To the Chief Electrical Inspector, Portland Maine:
 The undersigned hereby applies for a permit to make electrical installations
 in accordance with the laws of Maine, the City of Portland Electrical Ordinance,
 National Electrical Code and the following specifications:

Date 1/9/12
 Permit # 201214621
 CBL# 155A004001

LOCATION: 72 Wellwood Road METER MAKE & # _____
 CMP ACCOUNT # _____ OWNER Gus & Polly Goodwin
 TENANT _____ PHONE # 221-6342

TOTAL EACH FEE

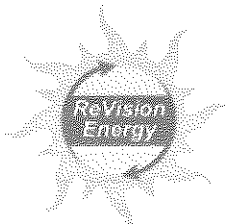
OUTLETS	Receptacles	Switches	Smoke Detector	.20
FIXTURES	Incandescent	Fluorescent	Strips	.20
SERVICES	Overhead	Underground	TTL AMPS <800	15.00
	Overhead	Underground	>800	25.00
Temporary Service	Overhead	Underground	TTL AMPS	25.00
				25.00
METERS	(number of)			1.00
MOTORS	(number of)			2.00
RESID/COM	Electric units			1.00
HEATING	oil/gas units	Interior	Exterior	5.00
APPLIANCES	Ranges	Cook Tops	Wall Ovens	2.00
	Insta-Hot	Water heaters	Fans	2.00
	Dryers	Disposals	Dishwasher	2.00
	Compactors	Spa	Washing Machine	2.00
Solar Panels	Others (denote)			2.00
MISC. (number of)	Air Cond/win			3.00
	Air Cond/cent		Pools	10.00
	HVAC	EMS	Thermostat	5.00
	Signs			10.00
	Alarms/res			5.00
	Alarms/com			15.00
	Heavy Duty (CRKT)			2.00
	Circus/Carnv			25.00
	Alterations			5.00
	Fire Repairs			15.00
	E Lights			1.00
	E Generators			20.00
PANELS	Service	Remote	Main	4.00
TRANSFORMER	0-25 Kva			5.00
	25-200 Kva			8.00
	Over 200 Kva			10.00
			TOTAL AMOUNT DUE	
			MINIMUM FEE/COMMERCIAL 55.00	45.00

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 Dept. of Building Inspections
 City of Portland Maine

CONTRACTORS NAME Revision Energy MASTER LIC. # MS60019303
 ADDRESS 142 Presumpscot St Portland LIMITED LIC. # _____
 TELEPHONE 221-6342 ME 04103

SIGNATURE OF CONTRACTOR [Signature]

2/8/2012 - Inspected & closed BKL



Professional design, installation and service of renewable energy systems

January 9, 2012

City of Portland
389 Congress Street
Portland, ME 04101

RE: ReVision Energy Solar Installation at 72 Wellwood Road
Address: 72 Wellwood Road, Portland

Dear Code Enforcement,

ReVision Energy has been contracted to design and install a solar electric system at the above address in Portland. This letter is to confirm that all work will be performed by licensed and qualified installers, expert in the field and in compliance with both manufacturer's recommendations and all applicable local and state codes and standards.

ReVision Energy employs licensed engineers, plumbers, and electricians and carries the solar industries highest certifications (NABCEP) in both solar thermal and photovoltaic installation. We're committed to high quality, code compliant work and look forward to working together with the city and the CEO to ensure that all your requirements and needs are met and that our customer ends up with a system that is beautiful, functional and safe.

Roof Structure

The roof can maintain and hold the proposed solar panels even in high winds.

If you have any questions or concerns, we'd like to address them as quickly and completely as possible. Please don't hesitate to call or e mail anytime.

Respectfully,

Fortunat Mueller, P.E.
Co-owner
ReVision Energy
(207) 752-6358
fortunat@revisionenergy.com

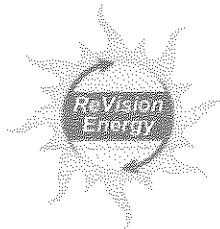
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Dept. of Building Inspections
City of Portland Maine

Bangor
207-570-4222

Liberty
207-589-4171

Portland
207-221-6342

Portsmouth
603-486-7170



Professional design, installation and service of renewable energy systems

4.3 Kilowatt Grid-Tied Photovoltaic System Proposal

Client: Gus & Polly Goodwin
 Address: 72 Wellwood Road, Portland, Maine 04101
 Date: 22 November 2011



Array Location
 (scale approximate;
 room for +4 modules
 on lower roof)

Roof Orientation:
 225 degrees
 (southwest)

Roof Pitch:
 8/12
 31 degree angle

Roof Material:
 Asphalt Shingle

Project Summary

System	Performance	Cost	Incentives	Net Cost
4.3 kilowatt Sunpower grid-tied PV array coupled with Enphase Energy microinverters	<ul style="list-style-type: none"> Produce roughly 5,340 kilowatt hours of clean, renewable electricity annually. Offset roughly 5,800 lbs. of CO2 emissions annually. Produce roughly 100% of your house's electricity (based on mean load of 445 kWh / mo.) 	\$23,772 Installed	-(\$7,132) fed tax credit -(\$2,000) State rebate	\$14,640

System Overview

Based on an evaluation of your household electricity demand and rooftop solar gain, ReVision Energy proposes a roof-mounted photovoltaic array of 4.3 kilowatts (nominal), utilizing superefficient SunPower 240-watt photovoltaic panels and Enphase Energy microinverters. The proposed array will consist of eighteen (18) panels, comprising two sub-arrays across the

Liberty
 207-589-4171

Portland
 207-221-6342

Exeter, NH
 603-486-7170

SUNPOWER

E19 / 240 SOLAR PANEL

MAXIMUM EFFICIENCY AND PERFORMANCE

BENEFITS

Highest Efficiency

SunPower™ Solar Panels are the most efficient photovoltaic panels on the market today.

More Power

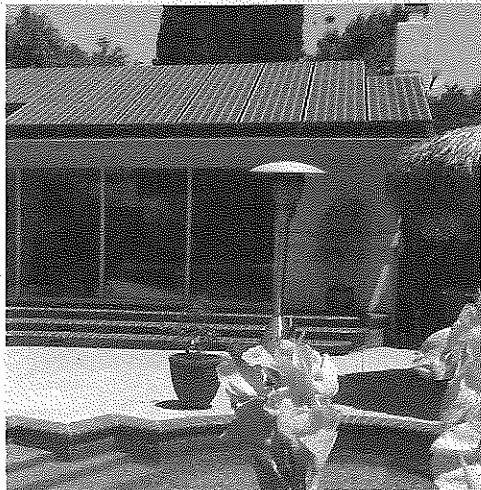
Our panels produce more power in the same amount of space—up to 50% more than conventional designs and 100% more than thin film solar panels.

Reduced Installation Cost

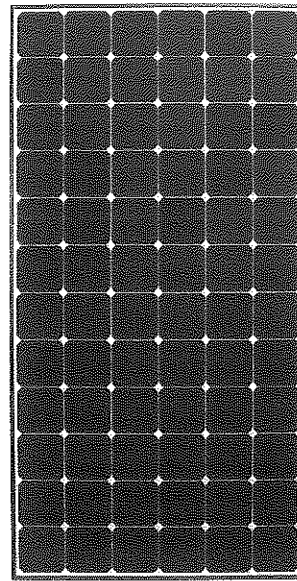
More power per panel means fewer panels per install. This saves both time and money.

Reliable and Robust Design

Proven materials, tempered front glass, and a sturdy anodized frame allow panel to operate reliably in multiple mounting configurations.

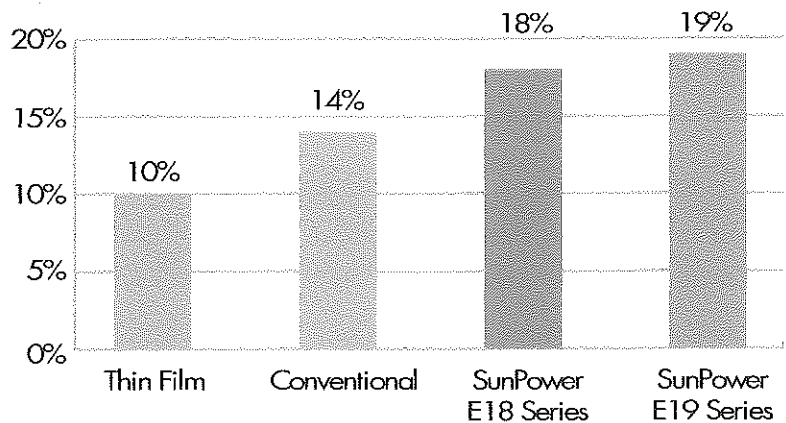


SPR-240E-WH-T-D



The SunPower™ 240 Solar Panel provides today's highest efficiency and performance. Utilizing 72 all back-contact solar cells, the SunPower 240 delivers a total panel conversion efficiency of 19.3%. The panel's reduced voltage-temperature coefficient, anti-reflective glass and exceptional low-light performance attributes provide outstanding energy delivery per peak power watt.

SunPower's High Efficiency Advantage



Electrical Data

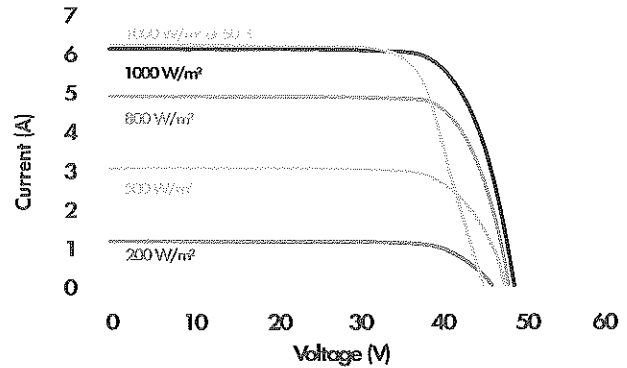
Measured at Standard Test Conditions (STC): irradiance of 1000W/m², AM 1.5, and cell temperature 25° C

Peak Power (+5/-3%)	P _{max}	240 W
Efficiency	η	19.3 %
Rated Voltage	V _{mpp}	40.5 V
Rated Current	I _{mpp}	5.93 A
Open Circuit Voltage	V _{oc}	48.6 V
Short Circuit Current	I _{sc}	6.30 A
Maximum System Voltage	UL	600 V
Temperature Coefficients	Power (P)	-0.38% / K
	Voltage (V _{oc})	-132.5mV / K
	Current (I _{sc})	3.5mA / K
NOCT		45° C +/-2° C
Series Fuse Rating		20 A

Mechanical Data

Solar Cells	72 SunPower all-back contact monocrystalline
Front Glass	High transmission tempered glass with anti-reflective (AR) coating
Junction Box	IP-65 rated with 3 bypass diodes Dimensions: 32 x 155 x 128 (mm)
Output Cables	1000mm length cables / MultiContact (MC4) connectors
Frame	Anodized aluminum alloy type 6063 (black)
Weight	33.1 lbs. (15.0 kg)

I-V Curve



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

Tested Operating Conditions

Temperature	-40° F to +185° F (-40° C to + 85° C)
Max load	113 psf 550kg/m ² (5400 Pa) front – e.g. snow; 50 psf 245kg/m ² (2400 Pa) front and back – e.g. wind
Impact Resistance	Hail 1 in (25 mm) at 52mph (23 m/s)

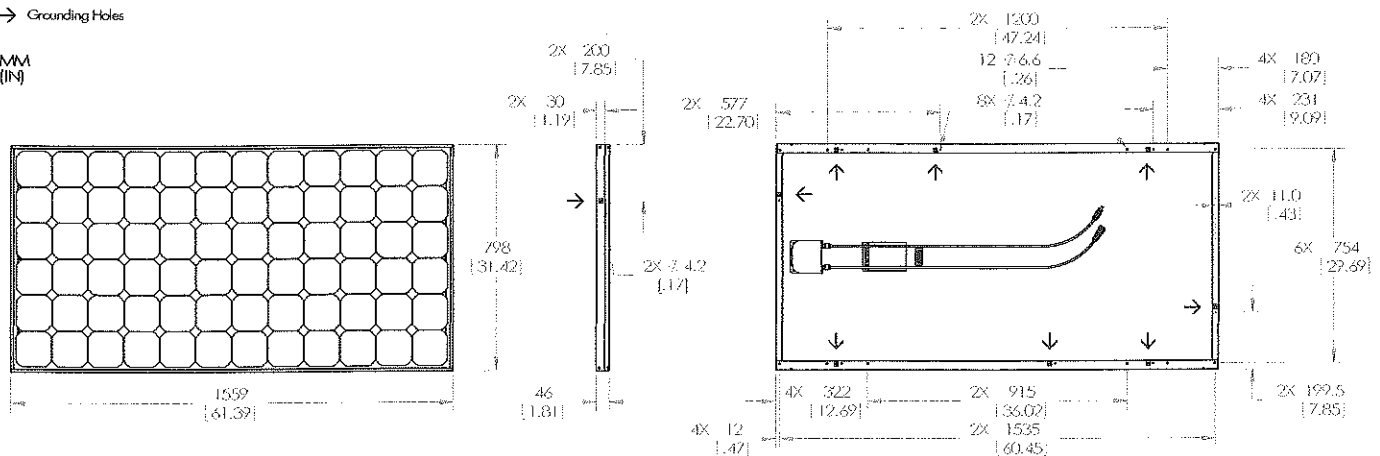
Warranties and Certifications

Warranties	25 year limited power warranty 10 year limited product warranty
Certifications	Tested to UL 1703, Class C Fire Rating

Dimensions

→ Grounding Holes

MM
(IN)



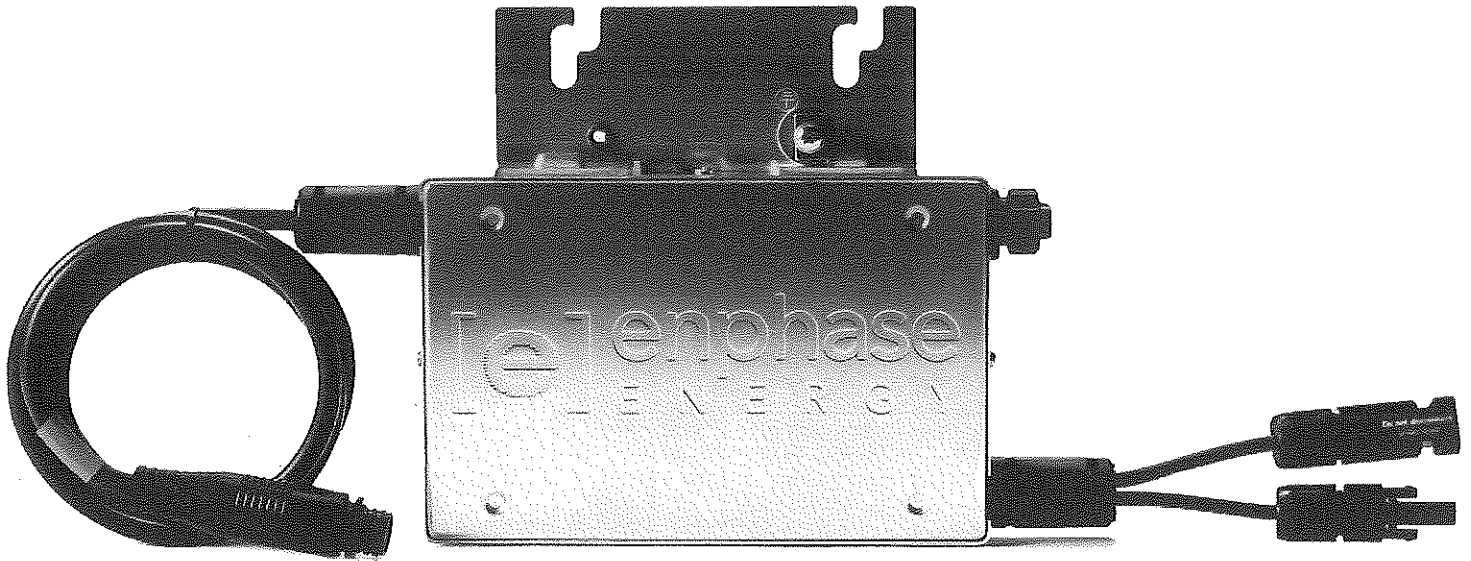
CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

Visit sunpowercorp.com for details.



ENPHASE MICROINVERTER

M210



The Enphase Energy Microinverter System improves energy harvest, increases reliability, and dramatically simplifies design, installation and management of solar power systems. The Enphase System includes the microinverter, the Envoy Communications Gateway, and the web-based Enlighten monitoring and analysis website.

- | | | |
|------------|---|---|
| PRODUCTIVE | [| <ul style="list-style-type: none">- Maximum energy production- Resilient to dust, debris and shading- Performance monitoring per module |
| RELIABLE | [| <ul style="list-style-type: none">- System availability greater than 99.8%- No single point of system failure |
| SMART | [| <ul style="list-style-type: none">- Quick & simple design, installation and management- 24/7 monitoring and analysis |
| SAFE | [| <ul style="list-style-type: none">- Low voltage DC- Reduced fire risk |



MICROINVERTER TECHNICAL DATA

	M210-84-208-S12	M210-84-240-S12
Input Data (DC)		
Recommended input power (STC)	240W	240W
Maximum input DC voltage	62V	62V
Peak power tracking voltage	31V – 50V	31V – 50V
Min./Max. start voltage	38V/62V	38V/62V
Max. DC short circuit current	12A	12A
Max. input current	10A	10A
Output Data (AC)		
Maximum output power	210W	210W
Nominal output current	1.00 A	.88 A
Nominal voltage/range	208V/183V-229V	240V/211V-264V
Extended voltage/range	208V/179V-232V	240V/206V-269V
Nominal frequency/range	60.0/59.3-60.5	60.0/59.3-60.5
Extended frequency/range	60.0/59.2-60.6	60.0/59.2-60.6
Power factor	>0.95	>0.95
Maximum units per branch	18	13
Efficiency		
Peak inverter efficiency	96.0%	96.0%
CEC weighted efficiency	95.5%	95.5%
Nominal MPP tracking	99.6%	99.6%
Mechanical Data		
Operating temperature range	-40°C to +65°C	-40°C to +65°C
Night time power consumption	30mW	30mW
Dimensions (WxHxD)	8" x 5.25" x 1.25"	
Weight	4.4 lbs	
Cooling	Natural Convection – No Fans	
Enclosure environmental rating	Outdoor – NEMA 6	
Features		
Communication	Powerline	
Warranty	15 Years	
Compliance	UL1741/IEEE1547 FCC Part 15 Class B	

Enphase Energy, Inc.

201 1st Street, Suite 300, Petaluma, CA 94952
877 797 4743 enphaseenergy.com

142-00006 REV 04

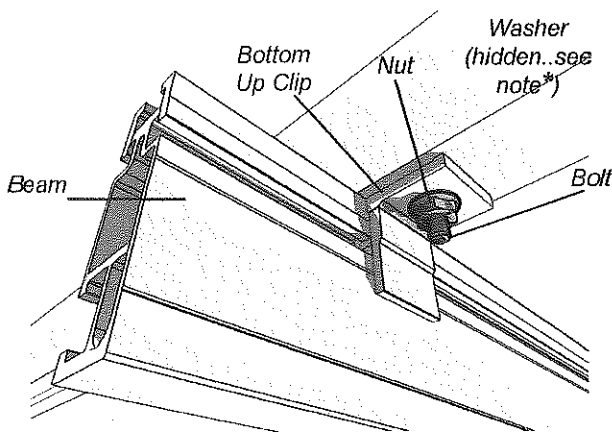
SolarMount Technical Datasheet

Pub 100602-1td V1.0 June 2010

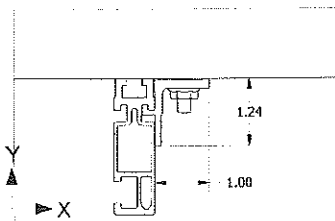
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SolarMount Module Connection Hardware

SolarMount Bottom Up Module Clip Part No. 321001, 321002



- **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

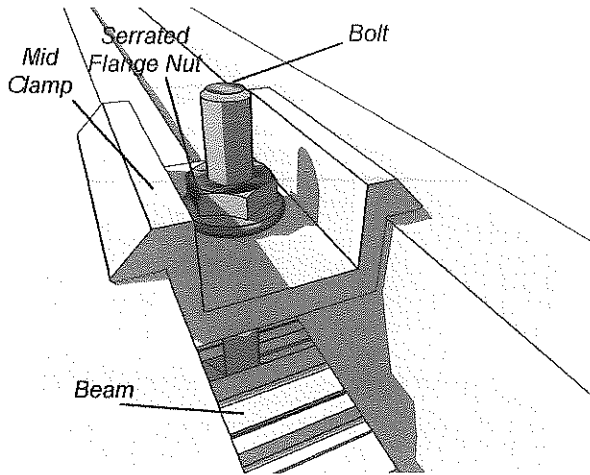


Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, ϕ
Tension, Y+	1566 (6967)	686 (3052)	2.28	1038 (4615)	0.662
Transverse, X±	1128 (5019)	329 (1463)	3.43	497 (2213)	0.441
Sliding, Z±	66 (292)	27 (119)	2.44	41 (181)	0.619

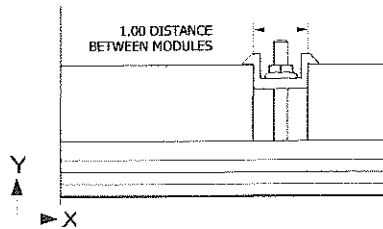
Dimensions specified in inches unless noted

SolarMount Mid Clamp

Part No. 320008, 320009, 320019, 320020, 320021, 320084, 320085, 320086, 320087, 320120, 320122



- **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

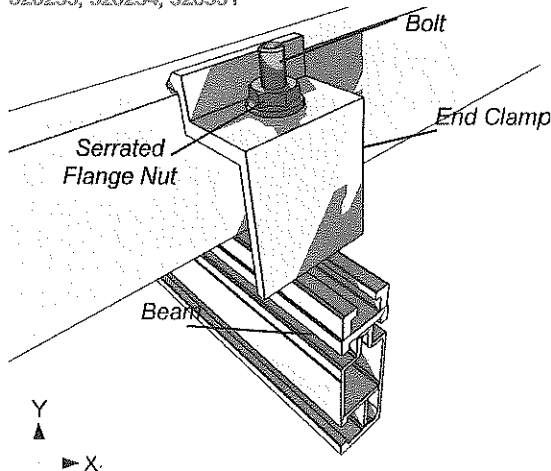


Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, ϕ
Tension, Y+	2020 (8987)	891 (3963)	2.27	1348 (5994)	0.667
Transverse, Z±	520 (2313)	229 (1017)	2.27	346 (1539)	0.665
Sliding, X±	1194 (5312)	490 (2179)	2.44	741 (3295)	0.620

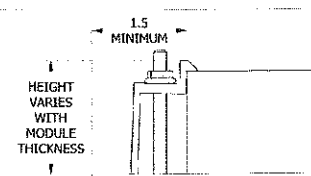
Dimensions specified in inches unless noted

SolarMount End Clamp

Part No. 320002, 320003, 320004, 320005, 320006, 320012, 320013, 320014, 320015, 320016, 320017, 320079, 320080, 320081, 320082, 320083, 320117, 320118, 320123, 320124, 320173, 320185, 320220, 320233, 320234, 320331



- **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



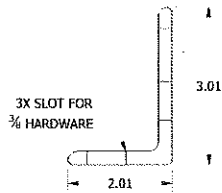
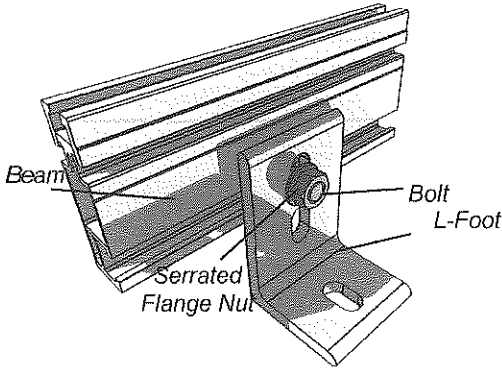
Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Loads lbs (N)	Resistance Factor, ϕ
Tension, Y+	1321 (5876)	529 (2352)	2.50	800 (3557)	0.605
Transverse, Z±	63 (279)	14 (61)	4.58	21 (92)	0.330
Sliding, X±	142 (630)	52 (231)	2.72	79 (349)	0.555

Dimensions specified in inches unless noted

SolarMount Beam Connection Hardware

SolarMount L-Foot

Part No. 310065, 310066, 310067, 310068



Dimensions specified in inches unless noted

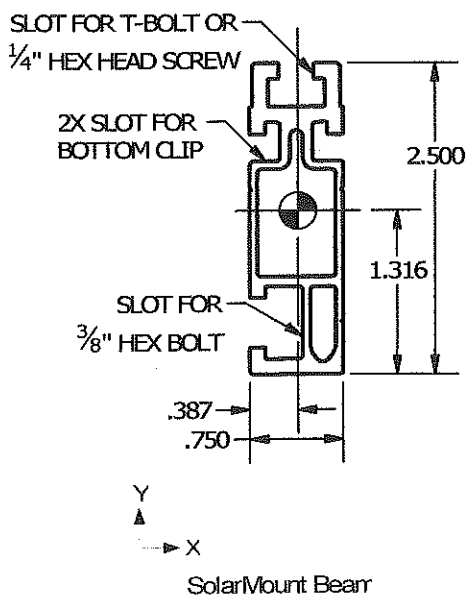
- **L-Foot material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **L-Foot weight:** varies based on height: ~0.215 lbs (98g)
- Allowable and design loads are valid when components are assembled 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

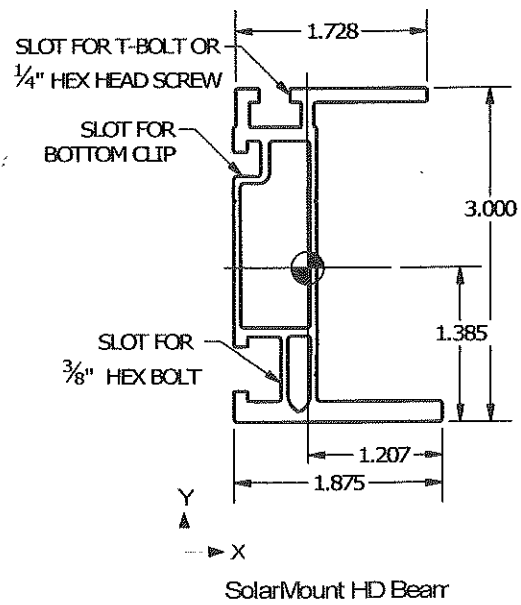
Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, ϕ
Sliding, Z \pm	1766 (7856)	755 (3356)	2.34	1141 (5077)	0.646
Tension, Y+	1859 (8269)	707 (3144)	2.63	1069 (4755)	0.575
Compression, Y-	3258 (14492)	1325 (5893)	2.46	2004 (8913)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

SolarMount Beams

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



SolarMount Beam



SolarMount HD Beam

Dimensions specified in inches unless noted