Building Permit Application
City of Portland, Oregon - Bureau of Development Services

1900 SW 4th Avenue, Portland, Oregon 97201 • 503-823-7310 • TTY 503-823-6868 • www.portlandoregon.gov/bds

This permit application expires if a permit is not obtained within 180 days after it has been accepted as complete.

Type of work

- ☐ New construction
- ☑ Addition/alteration/replacement
- ☐ Demolition
- ☐ Other:

Category of construction

- ☑ 1 & 2 family dwelling
- ☐ Commercial/industrial
- ☐ Accessory building
- ☐ Multifamily
- ☐ Master builder
- ☐ Other:

Office Use Only

Permit no:	
Date received:	
By:	

Job site information and location

Job no.: 9721023	Job address: 7530 SE Henderson St.
City/State/ZIP: Portland, OR 97206	
Suite/bldg./apt. no.:	Project name: Feuerborn
Cross street/directions to job site:	
Subdivision:	Lot no. / Tax map/parcel no.

Description of work

Roof mount PV system

☐ Reference RS / Combination — Permit no.

Required Data: One and Two Family Dwelling

Permit fees* are based on the value of the work performed. Indicate the value (rounded to the nearest dollar) of all equipment, materials, labor, overhead, and the profit for the work indicated on this application.

Valuation:	
Number of bedrooms:	
Number of bathrooms:	
Total number of floors:	
New dwelling area:	square feet
Garage/carport area:	square feet
Covered porch area:	square feet
Deck area:	square feet
Other structure area:	square feet

Required Data: Commercial Use

Permit fees* are based on the value of the work performed. Indicate the value (rounded to the nearest dollar) of all equipment, materials, labor, overhead, and the profit for the work indicated on this application.

Valuation:	
Existing building area:	square feet
New building area:	square feet
Number of stories:	
Type of construction:	
Occupancy groups	
Existing:	
New:	

Notice

All contractors and subcontractors are required to be licensed with the Oregon Construction Contractors Board under ORS 701 and may be required to be licensed in the jurisdiction in which work is being performed. If the applicant is exempt from licensing, the following reasons apply.

Statement of Fact: I certify that the facts and information set forth in this application are true and complete to the best of my knowledge. I understand that any falsification, misrepresentation or omission of fact (whether intentional or not) in this application or any other required document, as well as any misleading statement or omission, may be cause for revocation of permit and/or certificate of occupancy, regardless of how or when discovered.

Building Permit Fees*

Please refer to fee schedule

Fees due upon application	
Amount received	
Date received	

Sub-contractor information can be faxed to 503-823-7693.

Property owner ☐ Tenant

Name: Glen Feuerborn

Address:

City/State/ZIP:

Phone: FAX:

Owner installation: This installation is being made on property that I own, which is not intended for sale, lease, rent, or exchange.

Owner signature: Date:

Contractor

Business name: SolarCity Corporation

Address: 6132 NE 112th Ave.

City/State/ZIP: Portland, Oregon 97220

Phone: 503-956-0610 FAX: 503-536-6513

CCB lic. no. 180498

Authorized signature: Caitlin Horsley

Print name: Caitlin Horsley Date: 8/22/12

Applicant ☑ Contact Person

Business name: SolarCity Corporation

Contact name: Caitlin Horsley

Address: 6132 NE 112th Ave.

City/State/ZIP: Portland, Oregon 97220

Phone: 503-956-0610 FAX: 503-536-6513

E-mail: Chorsley@solarcity.com

Authorized signature: Caitlin Horsley

Print name: Caitlin Horsley Date: 8/22/12

Renewable Electrical Energy Permit Application
City of Portland, Oregon - Bureau of Development Services

1900 SW 4th Avenue, Portland, Oregon 97201 • 503-823-7363 • FAX 503-823-4172 • TTY 503-823-6868 • www.portlandoregon.gov/bds

This permit application expires if a permit is not obtained within 180 days after it has been accepted as complete.

Type of work

- ☐ New construction
- ☑ Addition/alteration/replacement
- ☐ Demolition
- ☐ Other:

Category of construction

- ☑ 1 & 2 family dwelling
- ☐ Commercial/industrial
- ☐ Accessory building
- ☐ Multifamily
- ☐ Master builder
- ☐ Other:

Job site information and location

Job no.: 9721023 | Job address: 7530 SE Henderson St.

City/State/ZIP: Portland, OR 97206

Suite/bldg./apt. no.: | Project name: Feuerborn

Cross street/directions to job site:

Subdivision: | Lot no. | Tax map/parcel no.

Description of work

Roof mount PV system

☐ Reference RS / Combination | Permit no.

Fee Schedule

Description	Qty.	Fee	Total	**
Renewable energy installation per systerm total				
5 kva or less		$130		2
5.01 to 15 kva	1	$186		2
15.01 to 25 kva		$243		2
Miscellaneous				
Describe:				
Hourly rate:		$151		
Each additional inspection over allowable in any of the above				
Per inspection		$92		
Investigation fee				
Other				
Electrical permit fees*				
Subtotal				
Plan review (25% of permit fee)				
State surcharge (12% of permit fee)				
TOTAL PERMIT FEE				

** Number of inspections allowed per permit.

☑ Property owner ☐ Tenant

Name: Glen Feuerborn

Address:

City/State/ZIP:

Phone: | FAX:

Owner installation: This installation is being made on property that I own, which is not intended for sale, lease, rent, or exchange.

Owner signature: Date:

☑ Contractor ☐ Subcontractor

Business name: SolarCity Corporation

Address: 6132 NE 112th Ave.

City/State/ZIP: Portland, OR 97220

Phone: 503-956-0610 | FAX: 503-536-6513

Elec. lic. no. C5162 | CCB lic. no. 180498

Metro or City lic no. | Date:

Supervising electrician Signature, required: Derek S. Crapp

Print name: Derek S. Crapp | License no. 52015

Authorized signature: Caitlin Horsley

Print name: Caitlin Horsley | Date: 8/22/12

☐ Applicant ☑ Contact Person

Business name: SolarCity Corporation

Contact name: Caitlin Horsley

Address: 6132 NE 112th Ave.

City/State/ZIP: Portland, OR 97220

Phone: 503-956-0610 | FAX: 503-536-6513

E-mail: chorsley@solarcity.com

RS Permit/No Fees Due ☐

Sub-contractor information can be faxed to 503-823-7693.

Non Prescriptive

City of Portland, Oregon - Bureau of Development Services

1900 SW Fourth Avenue • Portland, Oregon 97201 • 503-823-7300 • www.portlandoregon.gov/bds

Checklist and Submittal Requirements for Prescriptive Installations of Solar Photovoltaic and Solar Water Heating Systems in accordance with Oregon Solar Installation Specialty Code (OSISC)

Instructions

Complete the following with all the information requested. This form must be submitted along with the application for installation.

Property Owner Information

Property Owner Name: Glen Feuerborn Installation Address: 7530 SE Henderson St.

Day Phone: _____ Evening Phone: _____ Email: _____

Contractor: SolarCity Corporation CCB#: 180498

Day Phone: 503-956-0610 Evening Phone: _____ Email: chorsley@solarcity.com

PV Modules or Solar Water Heating Collectors

Manufacturer: Trina Solar Model Number: TSM-240 Listing Agency: UL1703

Site Plan and Structural Plan

- Attach a simple site plan showing the location of the PV or solar water heating system in relation to buildings, structures, property lines, and, as applicable, flood hazard areas.
- Attach a simple structural plan showing the roof framing (rafter size, type and spacing) and PV module system racking attachment. Plans must be shown in sufficient detail to assess whether the requirements of section 304.9 of OSISC or one of the exceptions have been met.
- Attach simple building elevation.
- The plans must be on 8.5 x 11 or larger paper.

Structural Information

Roof Design and Attachment

- Roof rafter size: 2 x 4 inches OR Manufactured Trusses
- Rafter or manufactured roof truss spacing _____ inches o.c.
- For roof rafters, maximum rafter span allowed per table 305.4.1 (Appendix "B") of the Oregon Solar Installation Specialty Code (OSISC) (www.oregonbcd.org/programs/solar/solar_code/100110_OSISC.pdf) for the size and spacing of roof rafters is ____ ft ____ inches.

Checklist to determine if your installation qualifies for prescriptive path

☑ Yes ☐ No Is this conventional light framed wood construction?

☐ Yes ☑ No Does the structure have pre-engineered trusses?

OR

Does structure have roof framing members spaced at 24" o.c. maximum AND comply with the applicable allowable span in table 305.4.1 (Appendix "B") of the Oregon Solar Installation Specialty Code (OSISC)?

☑ Yes ☐ No Is the roofing material metal, single layer wood shingle, or not more than two layers of composition shingle?

☑ Yes ☐ No Is the weight of the modules and racking less than 4.5 pounds per square foot?

☑ Yes ☐ No Is the module height less than 18 inches above the roof in accordance with section 305.4?

For Standing Seam Metal Roofs Only (If not applicable please skip this section)

☐ Yes ☐ No Is the metal gauge 26 or heavier?

☐ Yes ☐ No Clamp design: Are clamps designed to withstand uplift of at least 115 pounds for clamps spaced at 60 inches on center or less or at least 75 pounds for clamps spaced at 48 inches on center or less?

N/A

☐ Yes ☐ No Is the spacing of the clamps as measured along the seam greater than or equal to 24" o.c. and less than 60" o.c. AND the spacing perpendicular to the seam not greater than 24" o.c.?

☐ Yes ☐ No Is the roofing panel width 18-inches or greater?

☐ Yes ☐ No Is the roofing panel attached with at least #10 screws at 24" o.c.?

☐ Yes ☐ No Is the roofing panels installed over minimum 1/2-inch nominal wood structural panels attached to framing with 8d nails at 6" o.c. at panel edges and 12" o.c. field nailing?

If you have indicated "No" on any of these requirements above, the project may not be submitted using the prescriptive path.

Fire Fighter Access and Escape

Access and escape pathways are not required when the array is located on a non-occupied accessory structures that is separated from occupied structures by a 6 foot minimum separation distance or by a minimum two-hour fire rated assembly.

General Requirements: For all other roof mounted systems, a minimum 36" wide pathway is required along three sides of the solar roof, located over a structurally supported area. Any roof with a slope greater than 2:12 can not use the bottom roof edge as a pathway. Pathways and solar panels shall be located outside 12" of the low point of a valley.

If the array is greater than 150 feet in length or width, additional 36" wide intermediate pathways and cutouts are required. See code for details.

If the roof has smoke and/or heat vents, a 36" pathway shall be provided to and around each vent.

Exceptions to General Requirements:

☑ Yes ☐ No Is the roof slope greater than 2:12?

☑ Yes ☐ No Is the array area 1,000 sq ft or less?

☑ Yes ☐ No Is the array 150 feet or less in length or width?

If you have indicated "No" to any of the items above, exceptions do not apply, provide a simple plan conforming with the general requirements.

If you have indicated "Yes" to all of the items above, see below for reduced access and escape pathway requirements.

Is the array 25% or less of the roof area? ☑ Yes ☐ No

- If Yes, a 12" pathway along each side of any horizontal ridge is required.
- If No, a 12" pathway along each side of any horizontal ridge is required and a minimum of one 36" pathway is required from ridge to eave over a structurally supported area.

Provide a simple plan showing conformance to the reduced access pathway requirements.

As the property owner or authorized representative of the above listed property, I certify that I have verified the information provided above and that the roof rafters (if applicable to the project), meet the span requirements of Table 305.4.1 (Appendix B) of the Oregon Solar Installation Specialty Code.

Applicant name (please print) Caitlin Horsley **Signature** [signature] **Date** 8/22/12

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3055 Clearview Way
San Mateo, CA. 94402
(888)-SOL-CITY (765-2489) | www.solarcity.com

STRUCTURAL DESIGN CALCULATIONS
by YOO JIN KIM, P.E.

PROJECT:
Feuerborn Residence - Project # 9721023
5.28 kW Roof Mount Solar PV System
7530 SE Henderson St
Portland, OR. 97206

REPORT PREPARED FOR:
SolarCity, Inc.
3055 Clearview Way
San Mateo, CA. 94402
888-765-2489

OWNER:
Feuerborn, Glen J.
7530 SE Henderson St
Portland, OR. 97206
503-771-2280

PROJECT DESIGNED BY:
SolarCity, Inc.
3055 Clearview Way
San Mateo, CA. 94402
888-765-2489

Digitally signed by Yoo Jin Kim
Date: 2012.08.15 13:09:49 -07'00'

12-15252 PS

IN-HOUSE 64

3055 Clearview Way
San Mateo, CA. 94402
(888)-SOL-CITY (765-2489) | www.solarcity.com

Calculations by: YK
Reviewed by: YK

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5 Rafter/Beam Calculations
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- Seismic Spectral Response data from USGS web site

Design Criteria:
Designed to 2010 OSISC & 2010 OSSC
Dead Load= 9 psf (All MPs)
Roof Live Load = 20 psf (19 psf Reduced)
Basic Wind Speed = 95 mph
Exposure Category B
Roof Snow Load = 20 psf

ASCE7-2005 Open Structure Components and Cladding

Input Variables

Required Variables

mean roof height, ft	15
Exposure Category (6.5.6.3)	B
Basic Wind Speed (Figure 6-1 or local data)	95
Importance Factor (1 for residential)	1
Roof Shape	Pitched
Panel Tilt (degrees)	22.6 deg
Roof Zone	3
contiguous sq. feet of array	33
least width of the building	42
Obstructed wind flow?	TRUE

Local Topographical Features

(choose "standard " or refer to pictures right, and below)

type of hill	none
Hill Height (h) (ft)	
slope of hill (degrees)	
horizontal distance from hilltop to house(x)	
height from bottom of hill to mean roof height(z)	

Design Wind Pressures

P (lbs. per sq. ft.) = qh*Cn*G

Pd (downforce pressure) =	**9.35**
Pu (uplift pressure) =	**-24.48**

Max Tributary Area

Individual Rows in Portrait

Trina TSM-240PC

Amax (sq. ft.) = 0.5*L*X

L (length of panel in ft. perpendicular to rail	5.41
X (distance between standoffs in ft.)	4.00
Y (distance between standoffs in ft.)	2.67
Amax =	**10.83**

Dead Load Calculations

DL (lbs/sq. ft.) = (Mm+Mh)/(L*W)

L (length of Trina TSM-240PC modules)	5.41
W (width of Trina TSM-240PC modules)	3.09
Mm (weight of Trina TSM-240PC modules)	43.00
Mh (weight of hardware per module) =	7.70
DL =	**3.04**

Calculations and Values

Design Wind Pressures based upon:

ASCE 7-05 Chapter 6 Wind Loading

Equation 6.5.13.3: Component and Cladding Elements

Wind Pressure P = qh*G*Cn

6.5.10: Velocity Pressure

qh = 0.00256*Kz*Kzt*Kd*V^2*I

From Table 6-3:

Kz = 0.70

From Figure 6-4:

Kzt = 1.00

From Table 6-4:

Kd = 0.85

From figure 6-1:

V = 95

From table 6-1:

I = 1

From Velocity Pressure Equation:

qh = 13.75

From Figure 6-19B

Cn (down) = 0.80

Cn (uplift) = -2.10

From 6.5.8.1

G = 0.85

Max Uplift Force on a Single Standoff

Pmax (lbs.) = Amax*Pu + 0.6*PL*COSØ

Pmax = -266

Factor of Safety = Fl*D*Nl/Pmax

Fastner Type: Hex Lag Screw (Per Plans)

Fastener Diameter: 5/16" - 2.5" Min Embed

250 = Fl (pullout capacity of fastener (lbs/inch))

2.5 = D (minimum fastener thread depth)

1 = Nl (number of fasteners per standoff)

2.35 = Factor of Safety

Point Load Calculations

PL (lbs) = Amax*DL

PL = 33

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Landscape

ASCE7-2005 Open Structure Components and Cladding

Input Variables

Required Variables

mean roof height, ft	15
Exposure Category (6.5.6.3)	B
Basic Wind Speed (Figure 6-1 or local data)	95
Importance Factor (1 for residential)	1
Roof Shape	Pitched
Panel Tilt (degrees)	22.6 deg
Roof Zone	3
contiguous sq. feet of array	33
least width of the building	42
Obstructed wind flow?	TRUE

Local Topographical Features

(choose "standard " or refer to pictures right, and below)

type of hill	none
Hill Height (h) (ft)	
slope of hill (degrees)	
horizontal distance from hilltop to house(x)	
height from bottom of hill to mean roof height(z)	

Design Wind Pressures

P (lbs. per sq. ft.) = qh*Cn*G

Pd (downforce pressure) =	**9.35**
Pu (uplift pressure) =	**-24.48**

Max Tributary Area

Individual Rows in Landscape

Trina TSM-240PC

Amax (sq. ft.) = 0.5*L*X

L (length of panel in ft. perpendicular to rail	3.09
X (distance between standoffs in ft.)	4.00
Y (distance between standoffs in ft.)	2.67
Amax =	**6.17**

Dead Load Calculations

DL (lbs/sq. ft.) = (Mm+Mh)/(L*W)

L (length of Trina TSM-240PC modules)	5.41
W (width of Trina TSM-240PC modules)	3.09
Mm (weight of Trina TSM-240PC modules)	43.00
Mh (weight of hardware per module) =	7.70
DL =	**3.44**

Calculations and Values

Design Wind Pressures based upon:

ASCE 7-05 Chapter 6 Wind Loading

Equation 6.5.13.3: Component and Cladding Elements

Wind Pressure P = qh*G*Cn

6.5.10: Velocity Pressure

qh = 0.00256*Kz*Kzt*Kd*V^2*I

From Table 6-3:

Kz = 0.70

From Figure 6-4:

Kzt = 1.00

From Table 6-4:

Kd = 0.85

From figure 6-1:

V = 95

From table 6-1:

I = 1

From Velocity Pressure Equation:

qh = 13.75

From Figure 6-19B

Cn (down) = 0.80

Cn (uplift) = -2.10

From 6.5.8.1

G = 0.85

Max Uplift Force on a Single Standoff

Pmax (lbs.) = Amax*Pu + 0.6*PL*COSØ

Pmax = -152

Factor of Safety = Fl*D*Nl/Pmax

Fastner Type: Hex Lag Screw (Per Plans)

Fastener Diameter: 5/16" - 2.5" Min Embed

250 = Fl (pullout capacity of fastener (lbs/inch))

2.5 = D (minimum fastener thread depth)

1 = Nl (number of fasteners per standoff)

4.11 = Factor of Safety

Point Load Calculations

PL (lbs) = Amax*DL

PL = 22

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CALCULATION OF SOLAR PHOTOVOLTAIC ROOFTOP SYSTEM DEAD LOAD
All MPs
MODULE AND STAND-OFF CHARACTERISTICS

Module Make & Model:		Trina TSM-240PC
Panel Configuration:		Rows in Portrait
N_{mod} =	22	Quantity of Trina TSM-240PC modules
L_{mod} =	5.41 ft	Length of one Trina TSM-240PC module
W_{mod} =	3.09 ft	Width of one Trina TSM-240PC module
A_{mod} =	16.71 sf	Area of one Trina TSM-240PC module
Wt_{mod} =	43.00 lb	Weight of one Trina TSM-240PC module
DL_{mod} =	2.57 psf	Unit dead load of Trina TSM-240PC modules
Solar Rail Make & Model:		SolarCity Rail
Solar Rail Configuration:	X-X	Solar rails running in X-X direction
Wt_{rail} =	0.68 plf	Unit weight of aluminum solar rail, plf
Stand-off Make & Model:		SolarCity Yeti - 1 Lag
$Wt_{standoff}$ =	1.75 lb	Unit weight per stand-off assembly

PANEL AND RACK SYSTEM GEOMETRY

θ =	22.6 deg	Tilt of panel system from horizontal
θ_{roof} =	22.6 deg	Slope of roof mounting surface
h_{min} =	0.33 ft	Least panel height above roof surface (vertical dimension)
h_{max} =	0.33 ft	Greatest panel height above roof surface (vertical dimension)
h =	0.33 ft	Mean panel system height above roof surface (vertical dimension)
L_{x-x} =	3.09 ft	Array length in X-X Direction
S_{x-x} =	4.00 ft	Standoff spacing in X-X Direction
$N_{s,x-x}$ =	1	Number of standoffs in X-X Direction
L_{y-y} =	119.09 ft	Array length in Y-Y Direction (actual dimension at panel tilt θ)
$L_{h,y-y}$ =	109.93 ft	Horizontal projection of array length in Y-Y Direction
S_{y-y} =	2.67 ft	Standoff spacing in Y-Y Direction
$N_{s,y-y}$ =	44	Number of standoffs in Y-Y Direction

DETERMINATION OF SYSTEM DEAD LOAD FOR SEISMIC ANALYSIS

COMPONENT AREAS, LENGTHS, AND QUANTITIES

A_{system} =	368 sf	Gross area of solar PV system
$A_{modules}$ =	368 sf	Net area of solar modules only
N_{rail} =	44	Number of solar mounting rails
L_{rail} =	136 ft	Approximate total length of solar mounting rail
$N_{standoff}$ =	44	Number of stand-off assemblies

DEAD LOAD CALCULATION

Component	Length or Quantity		Unit Weight		Component Weight, lb
Solar Modules	22	x	43.00 lb	=	946
Solar Rails	136 ft	x	0.68 plf	=	92
Stand-off Assemblies	44	x	1.75 lb	=	77
			Subtotal for Hardware =		169 lb
			Total System Seismic DL =		1115 lb

Weight of Hardware per Solar Module =	7.70 lb
Weight of Modules per square foot of PV System =	2.57 psf
Weight of Hardware per square foot of PV System =	0.46 psf
Total Seismic System Weight per square foot =	3.03 psf

DETERMINATION OF DEAD AND LIVE LOADS:

All MPs

Element	DEAD LOAD Materials	Wt. (psf)			LIVE LOAD IBC 1607.11.2	
Roof:	Comp Shingle	5.00			L_0 =	20 psf
	Roofing Paper	0.50			A_{trib} =	<= 200 sf
	1/2 in. Plywood or OSB	1.50			R_1 =	1
	2 x 4 @ 24 in. o.c.	0.73	(Rafter)		R_2 =	0.95
	Miscellaneous	1.27		$L_r = L_0 * R_1 * R_2$ =		19 psf
		9.00				
	Roof Pitch 5:12	1.083		22.6 deg		
	Dead Load @ Roof Pitch =	9.75				
Ceiling:	2 x 4 @ 24 in. o.c.	0.73				
	Insulation	1.42				
	5/8 in. Gypsum Board	2.80				
	Miscellaneous	1.00				
		5.95				
Walls, Ext.:	Wood Siding	5.00				
	Building Paper	0.50				
	1/2 in. Plywood or OSB	1.50				
	2 x 4 @ 16 in. o.c.	2.00				
	1/2 in. Gypsum Board	2.20				
	Insulation & Misc.	1.00				
		12.20				
Walls, Interior	1/2 in. Gypsum Board	2.20				
	2 x 4 @ 16 in. o.c.	2.00				
	1/2 in. Gypsum Board	2.20				
		6.40				

SEISMIC DESIGN CALCULATIONS FOR SOLAR PV ROOF MOUNT SYSTEM
per 2009 IBC Section 1613 and ASCE 7-05 Chapter 13

SEISMIC DEAD LOAD

System Configuration: Flush Mount

W_p = 1115 lb See Dead Load Worksheet

PROJECT SITE DATA

Street Address: 7530 SE Henderson St
Portland, OR. 97206

Latitude and Longitude from Google Earth
Latitude: 45.47 deg
Longitude: -122.59 deg

Soil Site Class : D Default assumption per IBC 1613.5.2

SEISMIC GROUND MOTION VALUES

USGS Earthquake Ground Motion Parameter Calculator
http://earthquake.usgs.gov/hazards/designmaps/

F_a =	1.102	site coefficient from USGS web site
F_v =	1.726	site coefficient from USGS web site
S_S =	0.996 * g	Spectral response acceleration at short periods from USGS web site
S_1 =	0.337 * g	Spectral response acceleration at periods of 1 second, USGS web site

$S_{MS} = F_a * S_s$	(2009 IBC 16-37, ASCE 11.4-1)	S_{MS} =	1.098 * g
$S_{M1} = F_v * S_1$	(2009 IBC 16-38, ASCE 11.4-2)	S_{M1} =	0.582 * g
$S_{DS} = (2/3) * S_{MS}$	(2009 IBC 16-39, ASCE 11.4-3)	S_{DS} =	0.732 * g
$S_{D1} = (2/3) * S_{M1}$	(2009 IBC 16-40, ASCE 11.4-4)	S_{D1} =	0.388 * g

COMPONENT FACTORS FOR ASCE SECTION 13.3.1

a_p =	1.0	component amplification factor, ASCE Table 13.6-1
R_p =	1.5	component response modification factor, ASCE Table 13.6-1
I_p =	1.0	component importance factor, ASCE Section 13.1.3

SEISMIC DESIGN FORCE, PER ASCE SECTION 13.3.1

$$F_{p1} = \frac{0.4a_pS_{DS}W_p(1 + 2z/h)}{(R_p/I_p)}$$ Horizontal seismic design force (ASCE Equation 13.3-1)

where: $z =$ 15.00 ft
$h =$ 15.00 ft

$F_{p1} =$ 0.585 $W_p =$ 653 lb **Governs**

Fp is not required to be taken as greater than

$F_{p2} = 1.6S_{DS}I_pW_p$ (ASCE Equation 13.3-2)

$F_{p2} =$ 1.17 $W_p =$ 1306 lb

and Fp shall not be taken as less than

$F_{p3} = 0.3S_{DS}I_pW_p$ (ASCE Equation 13.3-3)

$F_{p3} =$ 0.22 $W_p =$ 245 lb

GOVERNING SEISMIC DESIGN FORCE

$F_p =$ 653 lb

ALTERATION DESIGN CHECK, PER 2009 IBC SECTION 3403.2.3.2:
(Seismic base shear is directly proportional to building mass)

Building Mass for Partial Building:

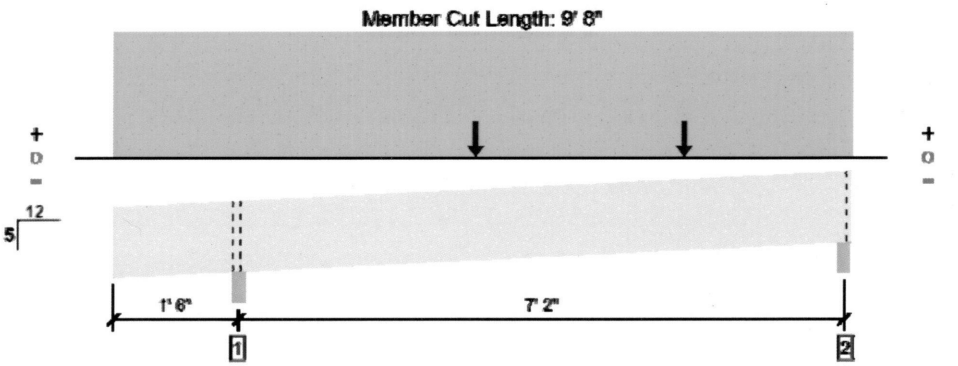
$Area_{roof} =$	672 sf	$DL_{Roof} =$	9.75 psf	$W_{roof} =$	6552 lb	
$Area_{clg} =$	672 sf	$DL_{Clg} =$	5.95 psf	$W_{clg} =$	3998 lb	
$Length_{Ext.wall} =$	60 ft	$DL_{Ext.wall} =$	12.20 psf	$W_{Ext.wall} =$	2928 lb	
$Length_{Int.wall} =$	60 ft	$DL_{Int.wall} =$	6.40 psf	$W_{Int.wall} =$	1536 lb	
Plate height?	8 ft			$W_{Roof} =$	15014 lb	(Existing)
				$W_{system} =$	1115 lb	
				$W_{proposed} =$	16129 lb	
			Percent Increase =		7.43 %	<=10% Therefore, okay

FORTE

MEMBER REPORT *Level, MP1*

PASSED

1 piece(s) 2 x 4 Douglas Fir-Larch No. 2 @ 24" OC



All Dimensions Are Horizontal; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	334 @ 1' 6"	2417	Passed (14%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	220 @ 1' 11"	725	Passed (30%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	404 @ 5' 3/4"	456	Passed (89%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.280 @ 5' 1 1/4"	0.385	Passed (L/330)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.492 @ 5' 1 1/8"	0.513	Passed (L/188)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC
Design Methodology : ASD
Member Pitch: 5/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Bracing (Lu): All compression edges (top and bottom) must be braced at 9' 2 11/16" o/c unless detailed otherwise. Proper attachment and positioning of lateral bracing is required to achieve member stability.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS 2005 methodology.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Beveled Plate - SPF	3.50"	3.50"	1.50"	126	208	334	Blocking
2 - Beveled Plate - SPF	3.50"	3.50"	1.50"	96	144	240	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform(PSF)	0 to 8' 9 3/4"	24"	9.0	20.0	Roof
2 - Point(lb)	4' 4"	N/A	33	-	PV DL
3 - Point(lb)	6' 10"	N/A	17	-	PV DL

Member Notes

Section A

Weyerhaeuser Notes

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The product application, input design loads, dimensions and support information have been provided by Forte Software Operator

SUSTAINABLE FORESTRY INITIATIVE

Forte Software Operator	Job Notes
Yoo Jin Kim SolarCity (650) 963-5100 x 5743 ykim@solarcity.com	

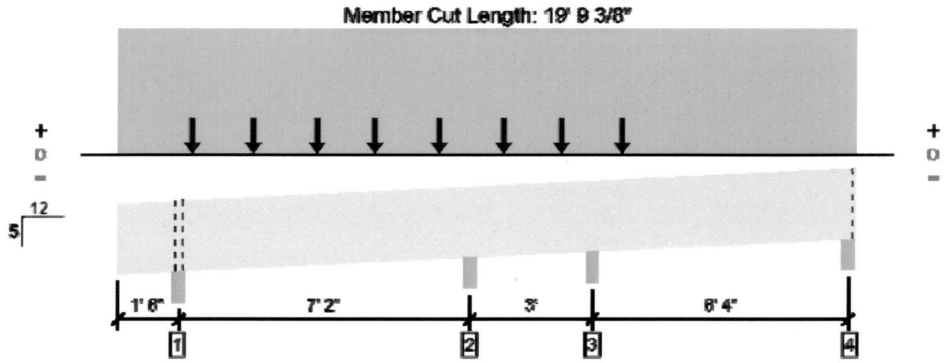
8/15/2012 1:06:12 PM
Forte v3.5, Design Engine: V5.5.3.2
972102~1.41F

FORTE

MEMBER REPORT *Level, MP3*

PASSED

1 piece(s) 2 x 4 Douglas Fir-Larch No. 2 @ 24" OC



All Dimensions Are Horizontal; Drawing is Conceptual

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	426 @ 8' 8"	2417	Passed (18%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	261 @ 8' 3"	725	Passed (36%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-292 @ 8' 8"	456	Passed (64%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.170 @ 4' 10 5/16"	0.388	Passed (L/549)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.301 @ 4' 10 1/8"	0.518	Passed (L/310)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC
Design Methodology : ASD
Member Pitch: 5/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Bracing (Lu): All compression edges (top and bottom) must be braced at 16' 2 13/16" o/c unless detailed otherwise. Proper attachment and positioning of lateral bracing is required to achieve member stability.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS 2005 methodology.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Beveled Plate - SPF	3.50"	3.50"	1.50"	130	187	317	Blocking
2 - Beveled Plate - SPF	3.50"	3.50"	1.50"	193	232	425	None
3 - Beveled Plate - SPF	3.50"	3.50"	1.50"	105	192	297	None
4 - Beveled Plate - SPF	3.50"	3.50"	1.50"	57	114	171	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Loads	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform(PSF)	0 to 18' 1 3/4"	24"	9.0	20.0	Roof
2 - Point(lb)	1' 10"	N/A	22	-	PV DL
3 - Point(lb)	3' 4"	N/A	11	-	PV DL
4 - Point(lb)	4' 11"	N/A	22	-	PV DL
5 - Point(lb)	6' 4"	N/A	11	-	PV DL
6 - Point(lb)	7' 11"	N/A	22	-	PV DL
7 - Point(lb)	9' 6"	N/A	11	-	PV DL
8 - Point(lb)	10' 11"	N/A	22	-	PV DL
9 - Point(lb)	12' 5"	N/A	11	-	PV DL

Member Notes

Section E

Weyerhaeuser Notes

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The product application, input design loads, dimensions and support information have been provided by Forte Software Operator

SUSTAINABLE FORESTRY INITIATIVE

Forte Software Operator	Job Notes
Yoo Jin Kim SolarCity (650) 963-5100 x 5743 ykim@solarcity.com	

8/15/2012 1:06:50 PM
Forte v3.5, Design Engine: V5.5.3.2
972102~1.4TF

SE Bybee Blvd
SE Rural St
SE Ogden St
SE Henderson St
SE Flavel St
SE Lambert St
SE Malden Ct
SE Henderson Ct
SE 74th Ave
SE 76th Ave
SE 78th Ave
SE 80th Ave
SE 82nd Ave
SE 69th Ave
SE 70th Ave
SE 71st Ave
SE 72nd Ave
SE 76th Pl
213
7530 SE Henderson St, Portland, OR
© 2012 Google
Google earth
Imagery Date: 8/26/2011
lat 45.469675° lon -122.585770° elev -244 ft
Eye alt 3525 ft

Conterminous 48 States
2005 ASCE 7 Standard
Latitude = 45.469675
Longitude = -122.58577
Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0 ,Fv = 1.0
Data are based on a 0.05 deg grid spacing

Period (sec)	Sa (g)
0.2	0.996 (Ss, Site Class B)
1.0	0.337 (S1, Site Class B)

Conterminous 48 States
2005 ASCE 7 Standard
Latitude = 45.469675
Longitude = -122.58577
Spectral Response Accelerations SMs and SM1
SMs = Fa x Ss and SM1 = Fv x S1
Site Class D - Fa = 1.102 ,Fv = 1.726

Period (sec)	Sa (g)
0.2	1.097 (SMs, Site Class D)
1.0	0.582 (SM1, Site Class D)

Conterminous 48 States
2005 ASCE 7 Standard
Latitude = 45.469675
Longitude = -122.58577
Design Spectral Response Accelerations SDs and SD1
SDs = 2/3 x SMs and SD1 = 2/3 x SM1
Site Class D - Fa = 1.102 ,Fv = 1.726

Period (sec)	Sa (g)
0.2	0.732 (SDs, Site Class D)
1.0	0.388 (SD1, Site Class D)

ABBREVIATIONS

A	AMPERE
AC	ALTERNATING CURRENT
BLDG	BUILDING
CONC	CONCRETE
C	COMBINER BOX
D	DISTRIBUTION PANEL
DC	DIRECT CURRENT
EGC	EQUIPMENT GROUNDING CONDUCTOR
(E)	EXISTING
EMT	ELECTRICAL METALLIC TUBING
G	SOLAR GUARD METER
GALV	GALVANIZED
GEC	GROUNDING ELECTRODE CONDUCTOR
GND	GROUND
HDG	HOT DIPPED GALVANIZED
I	CURRENT
Imp	CURRENT AT MAX POWER
INVS	INVERTERS
Isc	SHORT CIRCUIT CURRENT
kVA	KILOVOLT AMPERE
kW	KILOWATT
LBW	LOAD BEARING WALL
MIN	MINIMUM
(N)	NEW
NEC	NATIONAL ELECTRIC CODE
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
P	PANEL BOARD
PL	PROPERTY LINES
PV	PHOTOVOLTAIC
PVC	POLYVINYL CHLORIDE
S	SUBPANEL
SCH	SCHEDULE
SS	STAINLESS STEEL
SSD	SEE STRUCTURAL DRAWINGS
STC	STANDARD TESTING CONDITIONS
SWH	SOLAR WATER HEATER
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLT
Vmp	VOLTAGE AT MAX POWER
Voc	VOLTAGE AT OPEN CIRCUIT
W	WATT
3R	NEMA 3R, RAINTIGHT

ELECTRICAL NOTES

1. WHERE ALL TERMINALS OF THE DISCONNECTING MEANS MAY BE ENERGIZED IN THE OPEN POSITION, A SIGN WILL BE PROVIDED WARNING OF THE HAZARDS PER ART. 690.17.
2. EACH UNGROUNDED CONDUCTOR OF THE MULTIWIRE BRANCH CIRCUIT WILL BE IDENTIFIED BY PHASE AND SYSTEM PER ART. 210.5.
3. A NATIONALLY-RECOGNIZED TESTING LABORATORY SHALL LIST ALL EQUIPMENT IN COMPLIANCE WITH ART. 110.3.
4. CIRCUITS OVER 250V TO GROUND SHALL COMPLY WITH ART. 250.97, 250.92(B)
5. DC CONDUCTORS EITHER DO NOT ENTER BUILDING OR ARE RUN IN METALLIC RACEWAYS OR ENCLOSURES TO THE FIRST ACCESSIBLE DC DISCONNECTING MEANS PER ART. 690.31(E).
6. ALL WIRES SHALL BE PROVIDED WITH STRAIN RELIEF AT ALL ENTRY INTO BOXES AS REQUIRED BY UL LISTING.
7. MODULE FRAMES SHALL BE GROUNDED AT THE UL-LISTED LOCATION PROVIDED BY THE MANUFACTURER USING UL LISTED GROUNDING HARDWARE.
8. ALL EXPOSED METAL PARTS (MODULE FRAMES, RAIL, BOXES, ETC.) SHALL BE GROUNDED USING UL LISTED LAY-IN LUGS LISTED FOR THE PURPOSE. POSTS SHALL BE MADE ELECTRICALLY CONTINUOUS WITH ATTACHED RAIL.
9. MODULE FRAMES, RAIL, AND POSTS SHALL BE BONDED WITH EQUIPMENT GROUND CONDUCTORS AND GROUNDED AT THE MAIN ELECTRIC PANEL.
10. THE DC GROUNDING ELECTRODE CONDUCTOR SHALL BE SIZED ACCORDING TO ART. 250.166(B) & 690.47.

INDEX

PV1	COVER SHEET
PV2	PROPERTY PLAN
PV3	SITE PLAN
PV4	STRUCTURAL VIEWS
PV5	STRUCTURAL VIEWS
PV6	UPLIFT CALCULATIONS
PV7	SINGLE LINE
PV8	ELECTRICAL CALCULATIONS
PV9	LABELS & CUTSHEETS
PV10	CUTSHEETS
PV11	CUTSHEETS

GENERAL NOTES

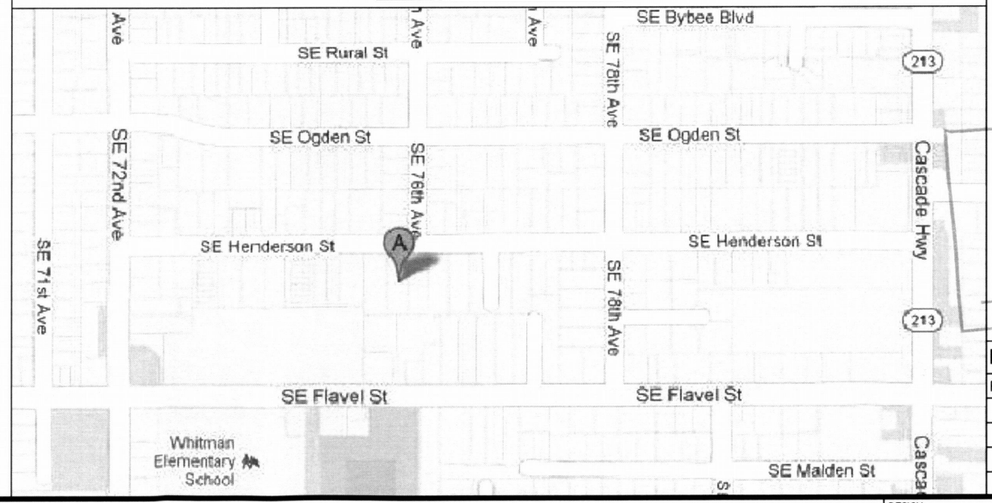
1. THIS SYSTEM IS GRID-INTERTIED VIA A UL-LISTED POWER-CONDITIONING INVERTER.
2. THIS SYSTEM HAS NO BATTERIES, NO UPS.
3. ALL INVERTERS AND ARRAYS ARE NEGATIVELY GROUNDED.
4. SOLAR MOUNTING FRAMES ARE TO BE GROUNDED.
5. ALL WORK TO BE DONE TO THE 2010 OBC BASED ON THE 2009 IBC.
6. ALL ELECTRICAL WORK SHALL COMPLY WITH THE CURRENT NATIONAL ELECTRIC CODE AS AMENDED BY THE OREGON ELECTRICAL SPECIALTY CODE.

LEGEND

- (M) (E) UTILITY METER & WARNING LABEL (6)*
- (Inv) INVERTER W/ INTEGRATED DC DISCO & WARNING LABELS (3),(4),(5),(6)
- DC DC DISCONNECT & WARNING LABELS (4),(5)
- AC AC DISCONNECT & WARNING LABELS (3),(4),(5),(6)
- (J) JUNCTION BOX
- (C) DC COMBINER BOX & WARNING LABELS (7),(9)
- (D) DISTRIBUTION PANEL & WARNING LABELS (1),(2)
- (LC) LOAD CENTER & WARNING LABELS (3),(4),(5),(6)
- (M) DEDICATED PV SYSTEM METER
- CONDUIT RUN ON EXTERIOR
- CONDUIT RUN ON INTERIOR
- GATE
- INTERIOR EQUIPMENT

*( ) NUMBERS REFER TO LABELS ON CUTSHEET PAGE

VICINITY MAP



LICENSE

OR # 180498

City of Portland
Bureau of
Development Services
By _____ Date 8-23-12
Approved by
Planning and Zoning Review

City of Portland
REVIEWED FOR CODE COMPLIANCE
AUG 22 2012
Permit Number

REV	BY	DATE	COMMENTS
REV *	*	*/*/*	*

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JOB NUMBER: JB-9721023 00

MARKET: RESI
PROJECT MANAGER:
PAYMENT TYPE: LEASE
MODULES: (22) TRINA SOLAR # TSM-240PA05
MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
INVERTER: (1) SMA # SUNNY BOY 5000-US

PREMISE OWNER: AHJ: Portland
FEUERBORN, GLEN J.
7530 SE HENDERSON ST
PORTLAND, OR 97206

5037712280

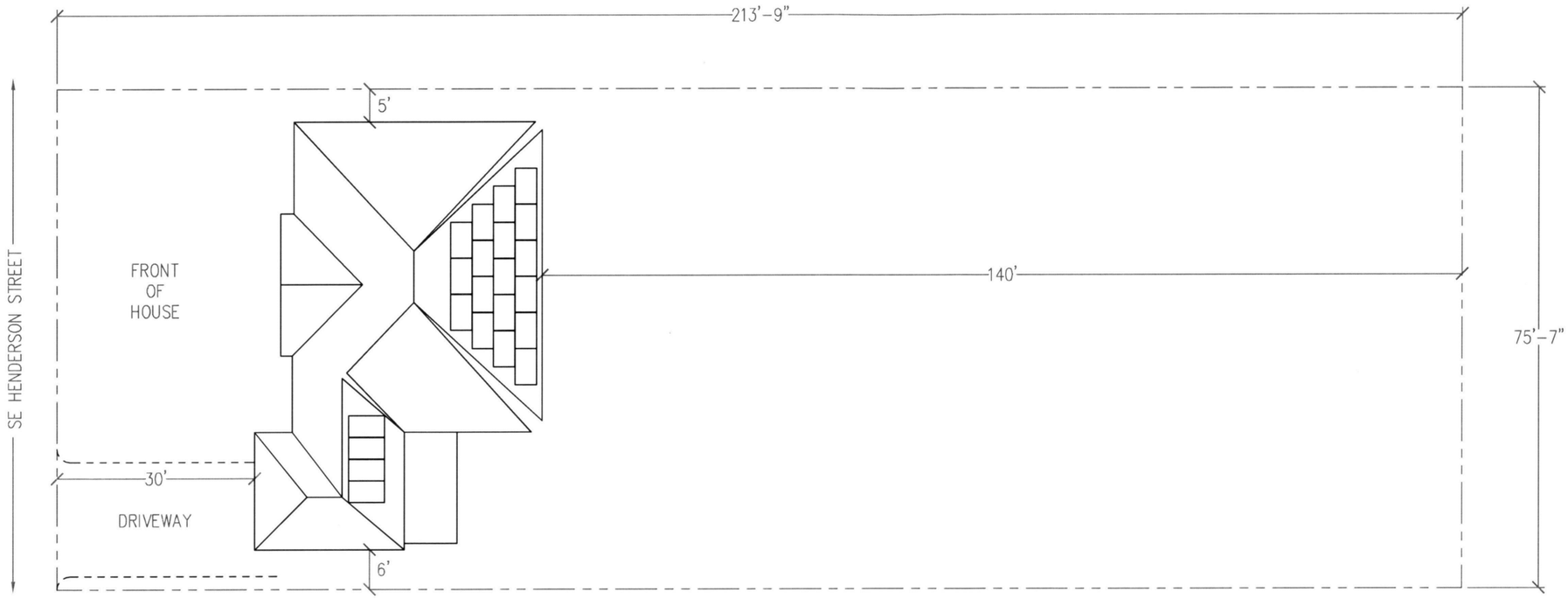
DESCRIPTION:
FEUERBORN RESIDENCE
5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME:
COVER SHEET

DESIGN: RASOR

SHEET: PV 1 REV: DATE: 7/18/2012

SolarCity
3055 Clearview Way
San Mateo, CA 94402
T:(650) 638-1028 | F:(650) 638-1029
(888)-SOL-CITY (765-2489) | www.solarcity.com



PROPERTY PLAN

Scale:1" = 20'

0' 20' 40'

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JOB NUMBER: JB-9721023 00

MARKET: RESI	MODULES: (22) TRINA SOLAR # TSM-240PA05
PROJECT MANAGER:	MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
PAYMENT TYPE: LEASE	INVERTER: (1) SMA # SUNNY BOY 5000-US

PREMISE OWNER: AHJ: Portland
FEUERBORN, GLEN J.
7530 SE HENDERSON ST
PORTLAND, OR 97206

5037712280

DESCRIPTION:
FEUERBORN RESIDENCE
5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME:
PROPERTY PLAN

DESIGN: RASOR

SHEET: PV 2 REV: DATE: 7/18/2012

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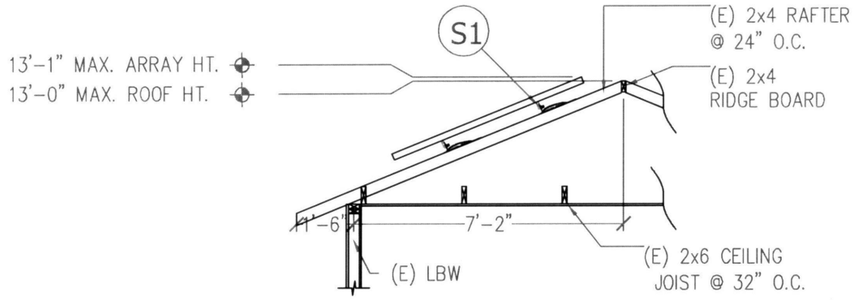
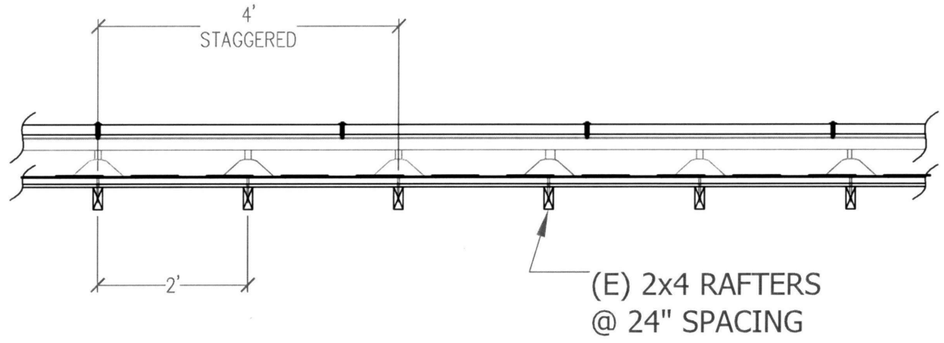


RAFTER:	2x4
SUPPORT:	2x4, 2x6
MAX SPAN:	7'-2"

A SIDE VIEW OF MP1

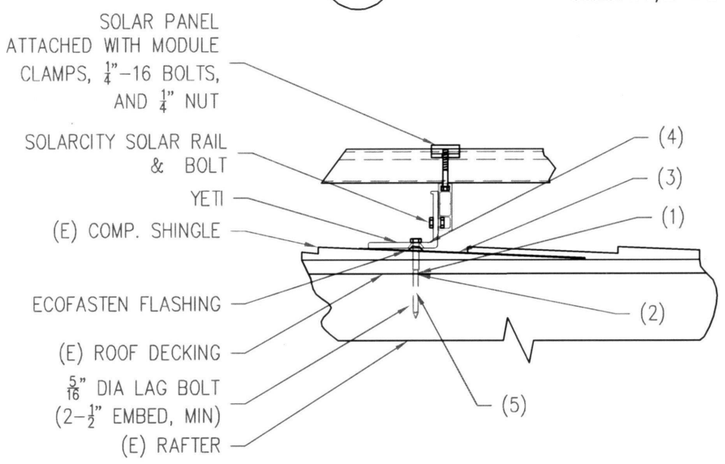


B FRONT VIEW OF MP1

SCALE: 1/2" = 1'

S1 STANDOFF

Scale: 1 1/2" = 1'



INSTALLATION ORDER	
(1)	LOCATE RAFTER, MARK HOLE LOCATION, AND DRILL PILOT HOLE.
(2)	SEAL PILOT HOLE WITH POLYURETHANE SEALANT.
(3)	INSERT ECOFASTEN FLASHING.
(4)	PLACE THE LEVELING FOOT.
(5)	INSTALL LAG WITH SEALING WASHER.

Digitally signed by Yoo Jin Kim
Date: 2012.08.16 07:38:20 -07'00'

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JOB NUMBER:	JB-9721023 00
MARKET: RESI	MODULES: (22) TRINA SOLAR # TSM-240PA05
PROJECT MANAGER:	MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
PAYMENT TYPE: LEASE	INVERTER: (1) SMA # SUNNY BOY 5000-US

PREMISE OWNER: AHJ: Portland
FEUERBORN, GLEN J.
7530 SE HENDERSON ST
PORTLAND, OR 97206

5037712280

DESCRIPTION:
FEUERBORN RESIDENCE
5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME:
STRUCTURAL VIEWS

DESIGN: RASOR

SHEET: PV 4 REV: DATE: 7/18/2012

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San Mateo, CA 94402
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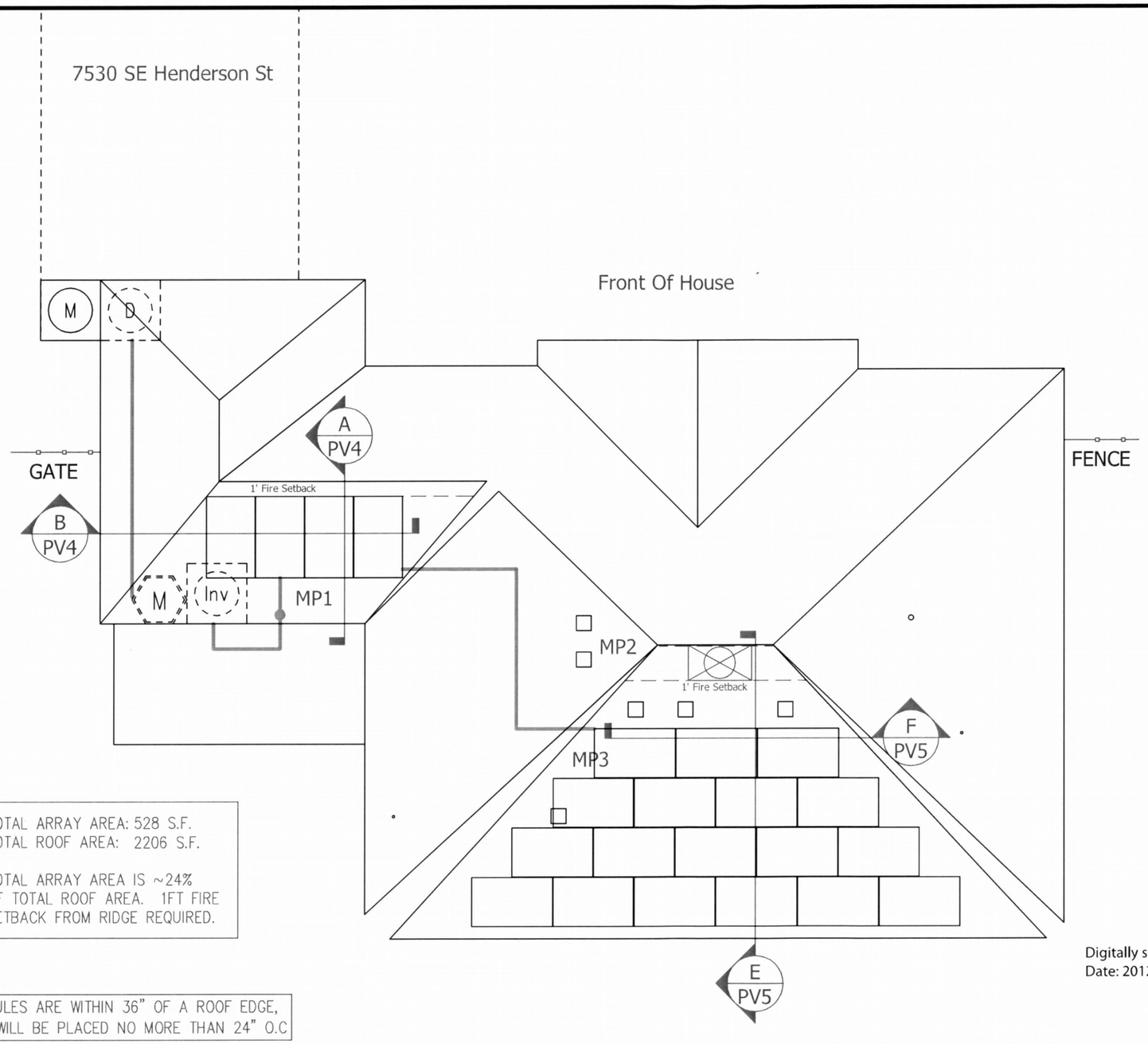

TOTAL ARRAY AREA: 528 S.F.
TOTAL ROOF AREA: 2206 S.F.

TOTAL ARRAY AREA IS ~24% OF TOTAL ROOF AREA. 1FT FIRE SETBACK FROM RIDGE REQUIRED.

WHEN MODULES ARE WITHIN 36" OF A ROOF EDGE, STANDOFFS WILL BE PLACED NO MORE THAN 24" O.C

MP1	– Roof Mounted SEE PV4 DETAILS A,B PITCH: 22 ARRAY PITCH: 22 AZIMUTH: 180 ARRAY AZIMUTH: 180 MATERIAL: Comp Shingle Roof STORY: 1
MP3	– Roof Mounted SEE PV5 DETAILS E,F PITCH: 22 ARRAY PITCH: 22 AZIMUTH: 180 ARRAY AZIMUTH: 180 MATERIAL: Comp Shingle Roof STORY: 1

LEGEND

- (M) (E) UTILITY METER & WARNING LABEL (6)*
- (Inv) INVERTER W/ INTEGRATED DC DISCO & WARNING LABELS (3),(4),(5),(6)
- DC DISCONNECT & WARNING LABELS (4),(5)
- AC DISCONNECT & WARNING LABELS (3),(4),(5),(6)
- (J) JUNCTION BOX
- (C) DC COMBINER BOX & WARNING LABELS (7),(9)
- (D) DISTRIBUTION PANEL & WARNING LABELS (1),(2)
- (LC) LOAD CENTER & WARNING LABELS (3),(4),(5),(6)
- (M) DEDICATED PV SYSTEM METER
- CONDUIT RUN ON EXTERIOR
- CONDUIT RUN ON INTERIOR
- GATE
- INTERIOR EQUIPMENT

*( ) NUMBERS REFER TO LABELS ON CUTSHEET PAGE

Digitally signed by Yoo Jin Kim
Date: 2012.08.16 07:38:10 -07'00'

SITE PLAN

Scale: 1/8" = 1'

N W E S

0 1' 8' 16'

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MARKET: RESI	MODULES: (22) TRINA SOLAR # TSM–240PA05
PROJECT MANAGER:	MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
PAYMENT TYPE: LEASE	INVERTER: (1) SMA # SUNNY BOY 5000–US

PREMISE OWNER: AHJ: Portland
FEUERBORN, GLEN J.
7530 SE HENDERSON ST
PORTLAND, OR 97206

5037712280

DESCRIPTION:
FEUERBORN RESIDENCE
5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME:
SITE PLAN

DESIGN: RASOR

SHEET: PV 3 REV: DATE: 7/18/2012

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San Mateo, CA 94402
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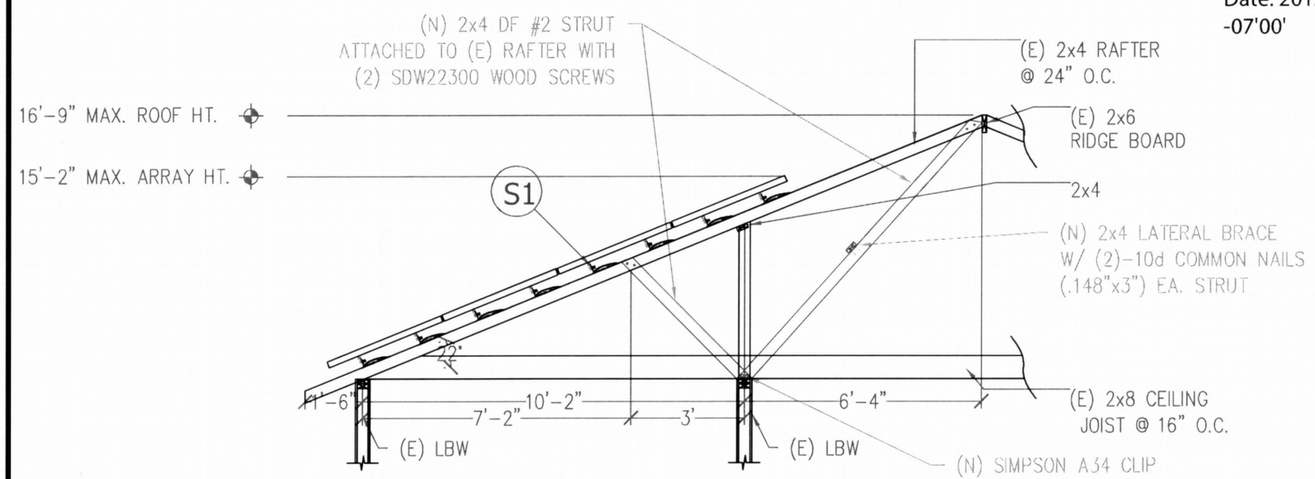
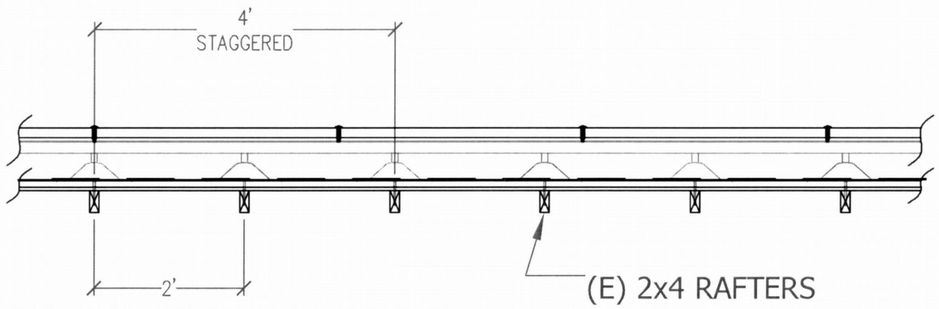
Digitally signed by Yoo Jin Kim
Date: 2012.08.16 07:38:32
-07'00'



NOTE: ADD STRUT SUPPORT TO ALL RAFTERS ON THIS MP SECTION INTO WHICH THE ARRAY IS LAGGED

RAFTER:	2x4
SUPPORT:	2x4, 2x8
MAX SPAN:	10'-2"

E SIDE VIEW OF MP3



F FRONT VIEW OF MP3

SCALE: 1/2" = 1'

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JOB NUMBER:	JB-9721023 00
MARKET: RESI	MODULES: (22) TRINA SOLAR # TSM-240PA05
PROJECT MANAGER:	MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
PAYMENT TYPE: LEASE	INVERTER: (1) SMA # SUNNY BOY 5000-US

PREMISE OWNER: AHJ: Portland
FEUERBORN, GLEN J.
7530 SE HENDERSON ST
PORTLAND, OR 97206

5037712280

DESCRIPTION:
FEUERBORN RESIDENCE
5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME:
STRUCTURAL VIEWS

DESIGN: RASOR

Permit Number

SHEET: PV 5 REV: DATE: 7/18/2012

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San Mateo, CA 94402
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UPLIFT CALCULATIONS

ASCE7-2005 Open Structure Components and Cladding

Input Variables		Calculations and Values
Required Variables		Design Wind Pressures based upon:
mean roof height, ft	15	ASCE 7-05 Chapter 6 Wind Loading
Exposure Category (6.5.6.3)	B	
Basic Wind Speed (Figure 6-1 or local data)	95	Equation 6.5.13.3: Component and Cladding Elements
Importance Factor (1 for residential)	1	**Wind Pressure P = qh*G*Cn**
Roof Shape	Pitched	6.5.10: Velocity Pressure
Panel Tilt (degrees)	22.6 deg	qh = 0.00256*Kz*Kzt*Kd*V^2*I
Roof Zone	3	
contiguous sq. feet of array	33	From Table 6-3:
least width of the building	42	Kz = 0.70
Obstructed wind flow?	TRUE	From Figure 6-4:
		Kzt = 1.00
Local Topographical Features		From Table 6-4:
(choose "standard " or refer to pictures right, and below)		Kd = 0.85
type of hill	none	From figure 6-1:
Hill Height (h) (ft)		V = 95
slope of hill (degrees)		From table 6-1:
horizontal distance from hilltop to house(x)		I = 1
height from bottom of hill to mean roof height(z)		
		From Velocity Pressure Equation:
		qh = 13.75
Design Wind Pressures		From Figure 6-19B
P (lbs. per sq. ft.) = qh*Cn*G		Cn (down) = 0.80
Pd (downforce pressure) =	**9.35**	Cn (uplift) = -2.10
Pu (uplift pressure) =	**-24.48**	From 6.5.8.1
		G = 0.85
Max Tributary Area		***Max Uplift Force on a Single Standoff***
Individual Rows in Portrait		**Pmax (lbs.) = Amax*Pu + 0.6*PL*COSØ**
Trina TSM-240PC		**Pmax = -266**
Amax (sq. ft.) = 0.5*L*X		**Factor of Safety = FI*D*NI/Pmax**
L (length of panel in ft. perpendicular to rail	5.41	**Fastner Type: Hex Lag Screw (Per Plans)**
X (distance between standoffs in ft.)	4.00	**Fastener Diameter: 5/16" - 2.5" Min Embed**
Y (distance between standoffs in ft.)	2.67	250 = FI (pullout capacity of fastener (lbs/inch))
Amax =	**10.83**	2.5 = D (minimum fastener thread depth)
		1 = NI (number of fasteners per standoff)
		2.35 = Factor of Safety
Dead Load Calculations		***Point Load Calculations***
DL (lbs/sq. ft.) = (Mm+Mh)/(L*W)		**PL (lbs) = Amax*DL**
L (length of Trina TSM-240PC modules)	5.41	**PL = 33**
W (width of Trina TSM-240PC modules)	3.09	
Mm (weight of Trina TSM-240PC modules)	43.00	
Mh (weight of hardware per module) =	7.70	
DL =	**3.04**	A Version 1_8

Digitally signed by Yoo Jin Kim
Date: 2012.08.16 07:38:44
-07'00'

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JOB NUMBER: JB–9721023 00
MARKET: RESI
PROJECT MANAGER:
PAYMENT TYPE: LEASE
MODULES: (22) TRINA SOLAR # TSM–240PA05
MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
INVERTER: (1) SMA # SUNNY BOY 5000–US

PREMISE OWNER: AHJ: Portland
FEUERBORN, GLEN J.
7530 SE HENDERSON ST
PORTLAND, OR 97206
5037712280

DESCRIPTION:
FEUERBORN RESIDENCE
5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME:
UPLIFT CALCULATIONS

DESIGN: RASOR
SHEET: PV 6 REV: DATE: 7/18/2012

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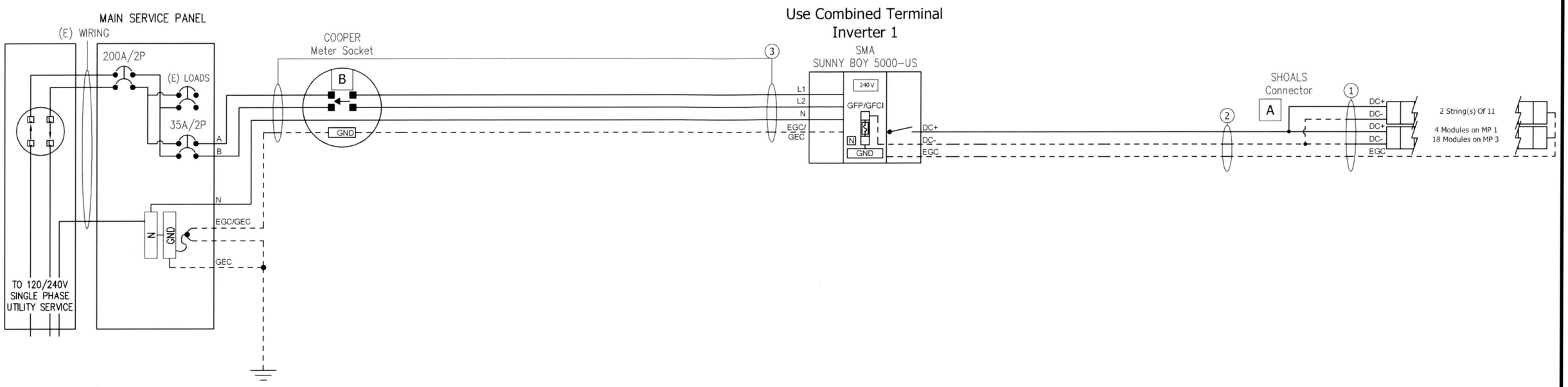
GROUND SPECS	MAIN PANEL SPECS	GENERAL NOTES	INVERTER SPECS	MODULE SPECS	LICENSE
BOND (N) #6 GEC TO (E) GROUND ROD AT PANEL WITH IRREVERSIBLE CRIMP	(E) 200A MAIN SERVICE PANEL (E) 200/2P MAIN CIRCUIT BREAKER Panel Number: B202040CT Meter Number: 25006036	Inv 1: DC Negatively Grounded	INV 1 — (1) SMA # SUNNY BOY 5000-US Inverter (-2011); 5000W, 277/240/208V, 95.5%/95.5%/95.5% INV 2 INV 3	— (22) TRINA SOLAR # TSM-240PA05 PV Module (-2011); 240W, 218.2W PTC, 40MM, Silver Frame Voc: 37.2 Vpmax: 30.4 *MODULE CURRENT RATINGS ARE SHOWN AS Isc AND Imp IN THE DC STRINGS IDENTIFIER OF THE SINGLE LINE DIAGRAM.	OR # 180498



POI — (1) CUTLER-HAMMER # BQC2302115 PV BACKFEED BREAKER
Breaker; 15A/1P-30A/2P-15A/1P, 2 Spaces, Quadplex

B — (1) COOPER # B Line Meter Socket 011
Meter Socket; 125A, 4-14AWG, Ring Type
— (1) AW CAP; B-Line Meter Socket Accessory
— (1) MILBANK # CL200
Meter; FORM 2S

AC

③ 25ft — (1) AWG #10, THWN-2, Black
— (1) AWG #10, THWN-2, Red
— (1) AWG #10, THWN-2, White NEUTRAL Vmp = 240 VAC Imp = 20.8 AAC
— (1) AWG #6, THWN-2, Green EGC/GEC — (1) Conduit Kit; 3/4" EMT

② 30ft — (2) AWG #10, USE-2/RHW-2, Black Voc = 409.2 VDC Isc = 16.74 ADC
— (1) AWG #10, Solid Bare Copper EGC Vmp = 334.4 VDC Imp = 15.78 ADC
— (1) Conduit Kit; 3/4" EMT

A — (1) SHOALS # STG.ICU.MMF.MC4
Connector; MC4 U-Joint Connector, Female
— (1) SHOALS # STG.ICU.FFM.MC4
Connector; MC4 U-Joint Connector, Male
— (1) SHOALS # STG.ICU.FFM.MC4
Connector; MC4 U-Joint Connector, Male
— (1) SHOALS # STG.ICU.MMF.MC4
Connector; MC4 U-Joint Connector, Female

DC

① 30ft — (4) AWG #10, USE-2/RHW-2, Black Voc = 409.2 VDC Isc = 8.37 ADC
— (1) AWG #10, Solid Bare Copper EGC Vmp = 334.4 VDC Imp = 7.89 ADC

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JOB NUMBER: JB-9721023 00

MARKET: RESI	MODULES: (22) TRINA SOLAR # TSM-240PA05
PROJECT MANAGER:	MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
PAYMENT TYPE: LEASE	INVERTER: (1) SMA # SUNNY BOY 5000-US

PREMISE OWNER: AHJ: Portland
FEUERBORN, GLEN J.
7530 SE HENDERSON ST
PORTLAND, OR 97206

5037712280

DESCRIPTION:
FEUERBORN RESIDENCE
5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME:
SINGLE LINE

DESIGN: RASOR

Permit Number

SHEET: PV 7 REV: DATE: 7/18/2012

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1. Conductor Sizing per Art 690.8(B)(1)
a. Conductor must have 30 deg. C ampacity >= 125% of continuous current per Art 215.2(A)(1).

b. Conductor must have (after corrections for conditions of use) >= continuous current per Table 310.16.

c. Evaluate conductor temperature at terminations per 110.14(C). Ampacity of wire derated for conditions of termination must be >= continuous current*1.25. All string terminations are rated at 90° C.

---

2. OCP Sizing per Art 690.8(B)(1)
a. Round up to next size per Art 240.4(B)

---

3. Conductor Sizing per Art 690.8(B)(1)
a. Conductor must have 30 deg. C ampacity >= 125% of continuous current per Art 215.2(A)(1).

b. Conductor must have (after corrections for conditions of use) >= continuous current per Table 310.16.

c. Evaluate conductor temperature at terminations per Art 110.14(C). Ampacity of wire derated for conditions of termination must be >= continuous current*1.25. All branch terminations are rated at 75° C min.

---

4. OCP Sizing
a. Round up to next size per Art 240.4(B)

---

5. Conductor Sizing per Art 690.8(B)(1)
a. Conductor must have 30 deg. C ampacity >= 125% of continuous current per Art 215.2(A)(1).

b. Conductor must have (after corrections for conditions of use) >= continuous current per Table 310.16.

c. Evaluate conductor temperature at terminations per Art 110.14(C). Ampacity of wire derated for conditions of termination must be >= continuous current*1.25. All inverter output terminations are rated at 75° C.

---

6. OCP Sizing
a. Round up to next size per Art 240.4(B)

7. Conductor Sizing per Art 690.8(B)(1)
a. Conductor must have 30 deg. C ampacity >= 125% of continuous current per Art 215.2(A)(1).

b. Conductor must have (after corrections for conditions of use) >= continuous current per Table 310.16.

c. Evaluate conductor temperature at terminations per Art 110.14(C). Ampacity of wire derated for conditions of termination must be >= continuous current*1.25. All inverter output terminations are rated at 75° C min.

ELECTRICAL CALCULATIONS

Module:	22	Trina TSM-240PA05	211	Inv Pwr	W PTC	StrLen
Inverter 1:	1	SMA SB-5000US (240V)	95.5%	5,000	4,433	11
Module:						
Inverter 2:						
Module:						
Inverter 3:						
Module:						
Inverter 4:						
Total:	22	modules		Total Inv Pwr	5,000	4,433 PTC

Photovoltaic Module Electrical Specifications: Total STC 5,280

			deg F	deg C
Voc=	37.2	V		
Vmp=	30.4	V	Record Low Temp:	8 -13.333
Isc=	8.37	A	Max Average Hi Temp:	81 27.222
Imp=	7.89	A	Record High Temp:	108 42
Tvoc=	-0.1302	V/deg C		
Tisc=	4.185	mA/deg C		

String Type A and 2 Combined Strings Type A — Voc Correction Method: Manuf Tvoc data

SMA SB-5000US (240V)

11	Trina TSM-240PA05		Inverter Min Vdc Input:	250	Vdc
Voc=	409.2	V	Min Vmp at Max Temp:	313	Vdc
Vmp=	334.4	V	Max Voc at Min Temp:	464	Vdc
Isc=	8.37	A	Inverter Max Vdc Input:	600	Vdc
Imp=	7.89	A	Max String Size:	14	
Icont=	10.46	A	Art 690.8(A)(1) 1-way wire length:	40	ft

1.a	Conductor: C AWG 10	USE-2/RHW-2 at 90 deg C: Table 310.15(B)(16)	
	Icont * 1.25 = (Amps)	13.08	
	30 deg C ampacity =	40	
1.b	Icont= (Amps)	10.46	
	Start ampacity	40	
	Temperature derate (%=F)	0.71	
	Conduit fill derate (%=#)	1	
	Derated ampacity	28.40	
1.c	Icont*1.25= (Amps)	13.08	
	Ampacity	40	
1.d	Icont * 1.25 = (Amps)	13.08	
	OCP size =	15	

Inverter Type A Output

SMA SB-5000US (240V) — 1-way wire length: 25 ft

Icont= 20.80 A — Art 690.8(A)(1)

3.a	Icont *1.25 = (Amps)	26.00	A	Art 690.8(B)(1)
	OCP size =	30	A	Art. 240.6(A)
3.b	Conductor C AWG 10	THWN-2 at 90 deg C: Table 310.15(B)(16)		
	Icont * 1.25 = (Amps)	26.00		
	30 deg C ampacity =	40		
3.c	Icont= (Amps)	20.80		
	Start ampacity	40		
	Temperature derate (%=F)	0.91		
	Conduit fill derate (%=#)	1		
	Derated ampacity	36.4		
3.d	Icont*1.25= (Amps)	26.00		
	Ampacity	35		
3.e	EGC =	C AWG 10		Art. 250.122
	GEC =	D AWG 08		Art. 690.47, 250.166(B)

Voltage Drop Calculations Version 5_8.16

Vdrop = (Imp) * (2 * Length) * (Resistance) / (Vmp)

	Imp (A)	Max. Length (ft)	Wire		
String:	7.89	40	C AWG 10	at Max Ave Hi:	81 deg F
Vdrop =	(7.89 A *	80 ft *	0.00124 Ohms) /	313 V =	0.25%
Branch:	15.78	50	C AWG 10	at Max Ave Hi:	81 deg F
Vdrop =	(15.78 A *	100 ft *	0.00124 Ohms) /	313 V =	0.63%
			Total voltage drop in DC conductors =		0.88%
Inverter:	20.80	25	C AWG 10	at 240V	
Vdrop =	(20.80 A *	50 ft *	0.00120 Ohms) /	240 V	0.52%
Combined:	20.83	0	D AWG 08	at 240V	
Vdrop =	(20.83 A *	0 ft *	0.00078 Ohms) /	240 V	0.00%
			Total voltage drop in AC conductors =		0.52%
			Total voltage drop in AC and DC conductors =		1.40%

Branch Circuit Type A — 1-way wire length: 50 ft

2	strings per branch 1	2	
11	modules per series string	10	
Voc=	409.2	V	
Vmp=	334.4	V	
Isc=	16.74	A	
Imp=	15.78	A	
Icont=	20.93	A	Art 690.8(A)(1)

2.a	Conductor 1 C AWG 10	THWN-2/USE-2 at 90 deg C: Table 310.15(B)(16)	
		Conductor 1:	
	Icont * 1.25 = (Amps)	26.16	
	30 deg C ampacity =	40	
2.b	Icont= (Amps)	20.93	
	Start ampacity	40	
	Temp. derate (%=F)	0.71	
	Cndt. fill derate (%=#)	1	
	Derated ampacity	28.4	
		Term 1	Term 2
	Temp table	75degC	75degC
2.c	Icont*1.25= (Amps)	26.16	26.16
	Ampacity	35	35
2.d	EGC	C AWG 10	C AWG 10 Art. 250.122
	OCP size =	30	

Combined Inverter Output

Service Voltage= 240 Volts

Total Inverter Power= 5,000 Watts — 1-way wire length: 0 ft

Icont = # of inverters*max inverter current — Art 690.8(A)(1)

	Icont = (Amps)	20.83		
4.a	Icont *1.25 = (Amps)	26.04	A	Art 690.8(B)(1)
	OCP size =	30	A	Art. 240.6(A)
4.b	Conductor D AWG 08	THWN-2 at 90 deg C: Table 310.15(B)(16)		
	Icont * 1.25 = (Amps)	26.04		
	30 deg C ampacity =	55		
4.c	Icont= (Amps)	20.83		
	Start ampacity	55		
	Temp. derate (%=F)	0.91		
	Cndt. fill derate (%=#)	1		
	Derated ampacity	50.05		
4.d	Icont*1.25= (Amps)	26.04		
	Ampacity	50		

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MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
PAYMENT TYPE: LEASE
INVERTER: (1) SMA # SUNNY BOY 5000–US

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DESIGN: RASOR AUG 22 2012

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LABELS

(1)

PHOTOVOLTAIC POINT OF INTERCONNECTION
WARNING! ELECTRIC SHOCK HAZARD!
DO NOT TOUCH TERMINALS ON BOTH THE LINE AND LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION. FOR SERVICE DE-ENERGIZE BOTH SOURCE AND MAIN BREAKER

PV POWER SOURCE	
MAXIMUM AC CIRCUIT OUTPUT OPERATING CURRENT	A
OPERATING AC VOLTAGE	V

SolarCity (888) SOL-CITY WWW.SOLARCITY.COM

(2)

PHOTOVOLTAIC AC DISCONNECT
WARNING! ELECTRIC SHOCK HAZARD!

OPERATING VOLTAGE	V
MAXIMUM OPERATING CURRENT	A

SolarCity (888) SOL-CITY WWW.SOLARCITY.COM

(3)

PHOTOVOLTAIC DC DISCONNECT
WARNING! ELECTRIC SHOCK HAZARD!

Voc	V
Vmp	V
Isc	A
Imp	A

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(4)

Solar Disconnect

WARNING – Electric Shock Hazard
DO NOT TOUCH TERMINALS
Terminals on both line and Load sides may be energized in the Open Position.

DC Disconnect

(5)

WARNING – Electric Shock Hazard
DO NOT TOUCH TERMINALS
Terminals on both line and Load sides may be energized in the Open Position.

DC VOLTAGE IS ALWAYS PRESENT WHEN SOLAR MODULES ARE EXPOSED TO SUNLIGHT

(6) WARNING – Dual Power Sources
Second source is photovoltaic system

(7) WARNING – Electric Shock Hazard
No user serviceable parts inside
Contact authorized servicer for assistance

(8) CAUTION
SOLAR PV SYSTEM INSTALLED. WHEN POWER IS DISCONNECTED SOLAR PANELS AND WIRING IN CONDUIT TO INVERTER MAY REMAIN ENERGIZED DURING DAYLIGHT HOURS.

(9) PV COMBINER BOX
WARNING:
ELECTRIC SHOCK HAZARD

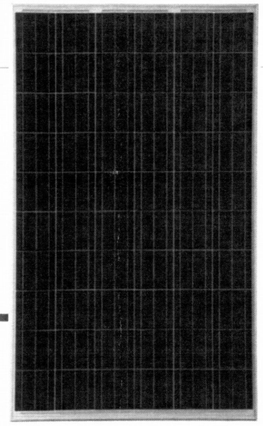
(10) WARNING
ELECTRICAL SHOCK HAZARD IF A GROUND FAULT IS INDICATED. THE NORMALLY GROUNDED CONDUCTORS MAY BE ENERGIZED AND UNGROUNDED

(11) WARNING
INVERTER OUTPUT CONNECTION
DO NOT RELOCATE
THIS OVER CURRENT DEVICE

PV MODULE

Mono Multi Solutions

TSM-PC05
TSM-PA05
The uniVeRSAl SoluTion



15.0%
MAX effICIenCY

245w
MAX POwer OuTPuT

10 YeAr
Pr ODuCT wArr AnTY

25 YeAr
lIneAr POwer wArr AnTY

Module can bear snow loads up to **5400Pa** and wind loads up to **2400Pa**

Guaranteed power output
0~+3%

high performance under low light conditions
Cloudy days, mornings and evenings

Independently certified by international certification bodies
IeC61215, IeC61730, ul1703, TuV Safety Class II, Ce

Manufactured according to international Quality and environment Management System Standards
ISO9001, ISO14001

Founded in 1997, Trina Solar is a vertically integrated PV manufacturer, involved in the production of ingots, wafers and cells to the assembly of high quality modules, using both mono and multicrystalline technologies. As of July 2011, the Company has already achieved an annualized nameplate module capacity of approximately 1.9GW. Trina Solar's wide range of products are used in residential, commercial, industrial and public utility applications throughout the world.

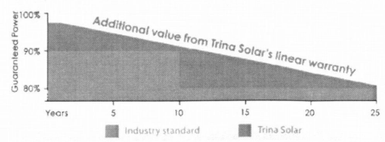
Only by matching an efficient cost-structure with proven performance will we as an industry achieve grid parity. And at Trina Solar, we have both.

Trina Solar Limited
www.trinasolar.com

Trinasolar
The power behind the panel

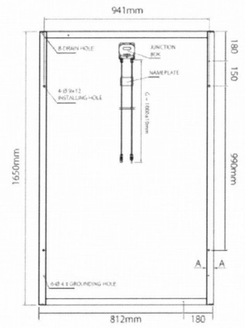
lIneAr PerfOrMAnCe wArr AnTY new

10 Year Prduct Warranty • 25 Year Linear Power Warranty

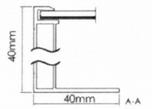


TSM-PC05 / TSM-PA05 The uniVeRSAl SoluTion

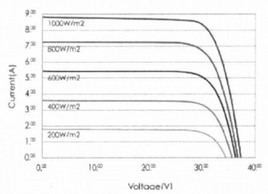
DIMenSIOnS Of PV MODule TSM-PC/PA 05



Back View



I-V Curves Of PV MODule TSM-230 PC/PA 05



Average efficiency reduction of 4.5% at 200W/m² according to EN 60904-1.

CerTIfICATIOn

electrical data @ STC	TSM-225 PC/PA05	TSM-230 PC/PA05	TSM-235 PC/PA05	TSM-240 PC/PA05	TSM-245 PC/PA05
Peak Power Watts-P_{MAX} (Wp)	225	230	235	240	245
Power Output Tolerance-P_{MAX} (%)	0/+3	0/+3	0/+3	0/+3	0/+3
Maximum Power Voltage-V_{MP} (V)	29.4	29.8	30.1	30.4	30.7
Maximum Power Current-I_{MPP} (A)	7.66	7.72	7.81	7.89	7.98
Open Circuit Voltage-V_{OC} (V)	36.9	37.0	37.1	37.2	37.3
Short Circuit Current-I_{SC} (A)	8.20	8.26	8.31	8.37	8.47
Module Efficiency η_m (%)	13.7	14.1	14.4	14.7	15.0

Values at Standard Test Conditions STC (Air Mass AM1.5, irradiance 1000W/m², Cell Temperature 25°C).

electrical data @ nOCT	TSM-225 PC/PA05	TSM-230 PC/PA05	TSM-235 PC/PA05	TSM-240 PC/PA05	TSM-245 PC/PA05
Maximum Power (W)	164	168	172	175	178
Maximum Power Voltage (V)	26.9	27.1	27.4	27.7	27.8
Maximum Power Current (A)	6.12	6.20	6.27	6.32	6.41
open Circuit Voltage (V)	33.8	33.9	34.0	34.1	34.2
Short Circuit Current (A)	6.62	6.68	6.70	6.75	6.83

nOCT: irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1M/s.

MeChAnICAl DATA	
Solar cells	Multicrystalline 156 × 156mm (6 inches)
Cell orientation	60 cells (6 × 10)
Module dimension	1650 × 992 × 40mm (64.95 × 39.05 × 1.57 inches)
Weight	19.5kg (43.0 lb)
Glass	high transparancy solar glass 3.2mm (0.13 inches)
Frame	Anodized aluminium alloy
J-Box	iP 65 rated
Cables / Connector	Photovoltaic Technology cable 4.0mm² (0.006 inches²), 1000mm (39.4 inches), MC4 / h4

TeMPer ATur e r ATIng S	
nominal operating Cell Temperature (nOCT)	46°C (±2°C)
Temperature Coefficient of P_{MAX}	-0.43%/°C
Temperature Coefficient of V_{OC}	-0.32%/°C
Temperature Coefficient of Isc	0.047%/°C

MAXIMuM r ATIng S	
operational Temperature	-40~+85°C
Maximum System Voltage	1000V DC(IeC)/ 600V DC(ul)
Max Series Fuse Rating	15A

wArr AnTY
10 year workmanship warranty
25 year linear performance warranty
(Please refer to product warranty for details)

PACkAgIng COnfIgur ATIOn
Modules per box: 25 pcs
Modules per 40' container: 650 pcs

TSM_en_oct_2011

Trinasolar
The power behind the panel

CAuTIon: ReAD SAFeTY AnD InSTAll ATIon InSTRuCTIonS BeFOre uSInG The PRODuCT.
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JOB NUMBER: JB–9721023 00

MARKET: RESI
MODULES: (22) TRINA SOLAR # TSM–240PA05
PROJECT MANAGER:
MOUNTING SYSTEM: SOLARCITY YETI STANDOFF
PAYMENT TYPE: LEASE
INVERTER: (1) SMA # SUNNY BOY 5000–US

PREMISE OWNER: FEUERBORN, GLEN J.
7530 SE HENDERSON ST
PORTLAND, OR 97206

5037712280

AHJ: Portland

DESCRIPTION:
FEUERBORN RESIDENCE
5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME: LABELS & CUTSHEETS

DESIGN: RASOR

City of Portland REVIEWED FOR CODE COMPLIANCE AUG 22 2012 Permit Number

SHEET: PV 9 REV: DATE: 7/18/2012

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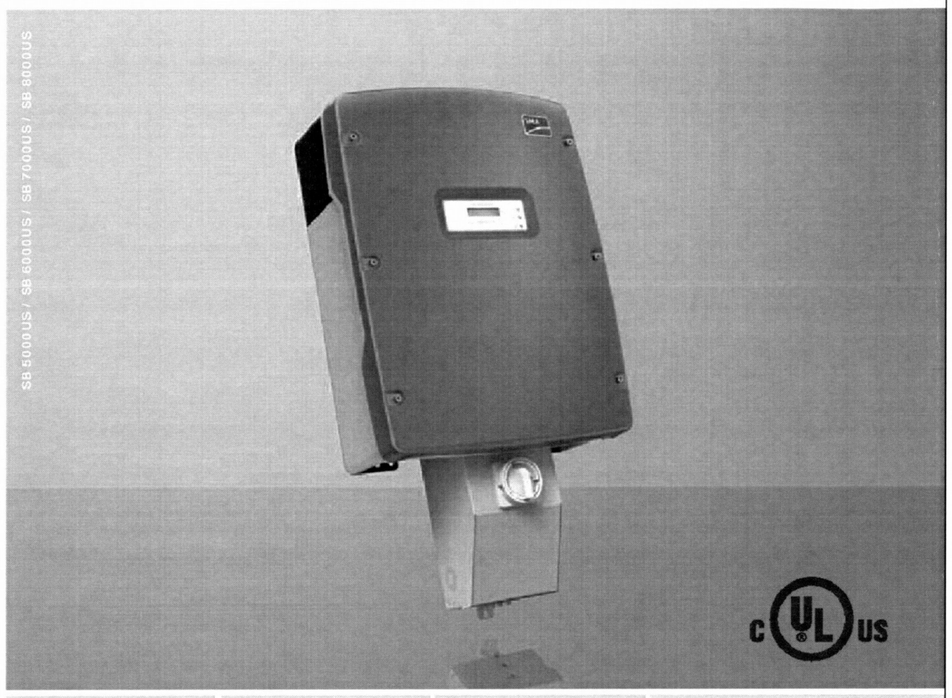
INVERTER

SUNNY BOY 5000-US / 6000-US / 7000-US / 8000-US



UL Certified
- For countries that require UL certification (UL 1741/IEEE 1547)

Efficient
- 97% peak efficiency
- OptiCool™ active temperature management system

Safe
- Galvanic isolation

Simple
- Patented automatic grid voltage detection*
- Integrated DC disconnect switch

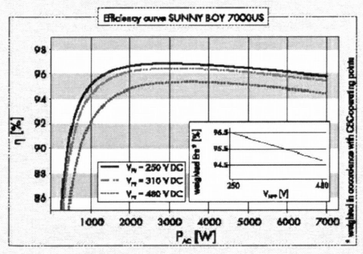
SUNNY BOY 5000-US / 6000-US / 7000-US / 8000-US

Versatile performer with UL certification

The Sunny Boy 5000-US, 6000-US, 7000-US and 8000-US inverters are UL certified and feature excellent efficiency. Graduated power classes provide flexibility in system design. Automatic grid voltage detection* and an integrated DC disconnect switch simplify installation, ensuring safety as well as saving time. These models feature galvanic isolation and can be used with all types of modules—crystalline as well as thin-film.

* US Patent US7352498B1

Technical data	Sunny Boy 5000-US			Sunny Boy 6000-US			Sunny Boy 7000-US			Sunny Boy 8000-US	
	208 V AC	240 V AC	277 V AC	208 V AC	240 V AC	277 V AC	208 V AC	240 V AC	277 V AC	240 V AC	277 V AC
Input (DC)											
Max. recommended PV power (@ module STC)	6250 W			7500 W			8750 W			10000 W	
Max. DC power (@ cos φ = 1)	5300 W			6350 W			7400 W			8600 W	
Max. DC voltage	600 V			600 V			600 V			600 V	
DC nominal voltage	310 V			310 V			310 V			345 V	
MPP voltage range	250 V – 480 V			250 V – 480 V			250 V – 480 V			300 V – 480 V	
Min. DC voltage / start voltage	250 V / 300 V			250 V / 300 V			250 V / 300 V			300 V / 365 V	
Max. input current / per string (at DC disconnect)	21 A / 20 A 36 A @ combined terminal			25 A / 20 A 36 A @ combined terminal			30 A / 20 A 36 A @ combined terminal			30 A / 20 A 36 A @ combined terminal	
Number of MPP trackers / fused strings per MPP tracker	1 / 4 (DC disconnect)										
Output (AC)											
AC nominal power	5000 W			6000 W			7000 W			7680 W	8000 W
Max. AC apparent power	5000 VA			6000 VA			7000 VA			8000 VA	
Nominal AC voltage / adjustable	208 V / ●	240 V / ●	277 V / ●	208 V / ●	240 V / ●	277 V / ●	208 V / ●	240 V / ●	277 V / ●	240 V / ●	277 V / ●
AC voltage range	183 - 229 V	211 - 264 V	244 - 305 V	183 - 229 V	211 - 264 V	244 - 305 V	183 - 229 V	211 - 264 V	244 - 305 V	211 - 264 V	244 - 305 V
AC grid frequency; range	60 Hz; 59.3 – 60.5 Hz			60 Hz; 59.3 – 60.5 Hz			60 Hz; 59.3 – 60.5 Hz			60 Hz; 59.3 – 60.5 Hz	
Max. output current	24 A	21 A	18 A	29 A	25 A	22 A	34 A	29 A	25 A	32 A	
Power factor (cos φ)	1			1			1			1	
Phase conductors / connection phases	1 / 2	1 / 2	1 / 1	1 / 2	1 / 2	1 / 1	1 / 2	1 / 2	1 / 1	1 / 2	1 / 1
Harmonics	< 4%			< 4%			< 4%			< 4%	
Efficiency											
Max. efficiency	96.7%	96.8%	96.8%	96.9%	96.8%	97.0%	97.1%	96.9%	97.0%	96.3%	96.5%
CEC efficiency	95.5%	95.5%	95.5%	95.5%	95.5%	96.0%	95.5%	96.0%	96.0%	96.0%	96.0%
Protection devices											
DC reverse-polarity protection	●			●			●			●	
AC short circuit protection	●			●			●			●	
Galvanically isolated / all-pole sensitive monitoring unit	●/–			●/–			●/–			●/–	
Protection class / overvoltage category	I / III			I / III			I / III			I / III	
General data											
Dimensions (W / H / D) in mm (in)	470 / 615 / 240 (18.5 / 24 / 9)										
DC Disconnect dimensions (W / H / D) in mm (in)	187 / 297 / 190 (7 / 12 / 7.5)										
Packing dimensions (W / H / D) in mm (in)	390 / 580 / 800 (16 / 23 / 31.5)										
DC Disconnect packing dimensions (W / H / D) in mm (in)	370 / 240 / 280 (15 / 9 / 11)										
Weight / DC Disconnect weight	64 kg (141 lb) / 3.5 kg (8 lb)									66 kg (145 lb) / 3.5 kg (8 lb)	
Packing weight / DC Disconnect packing weight	67 kg (147 lb) / 4 kg (9 lb)									69 kg (152 lb) / 4 kg (9 lb)	
Operating temperature range (full power)	-25 °C ... +45 °C (-13 °F ... +113 °F)										
Noise emission (typical)	44 dB(A)			45 dB(A)			46 dB(A)			49 dB(A)	
Internal consumption at night	0.1 W			0.1 W			0.1 W			0.1 W	
Topology	LF transformer			LF transformer			LF transformer			LF transformer	
Cooling concept	OptiCool			OptiCool			OptiCool			OptiCool	
Electronics protection rating / connection area	NEMA 3R / NEMA 3R			NEMA 3R / NEMA 3R			NEMA 3R / NEMA 3R			NEMA 3R / NEMA 3R	
Features											
Display: text line / graphic	●/–			●/–			●/–			●/–	
Interfaces: RS485 / Bluetooth	o/o			o/o			o/o			o/o	
Warranty: 10 / 15 / 20 years	●/o/o			●/o/o			●/o/o			●/o/o	
Certificates and permits (more available on request)	UL1741, UL1998, IEEE 1547, FCC Part 15 (Class A & B), CSA C22.2 No. 107.1-2001										
NOTE: US inverters ship with gray lids.											
Data at nominal conditions											
● Standard features o Optional features – Not available											
Type designation	SB 5000US			SB 6000US			SB 7000US			SB 8000US	



Accessories

- RS485 interface 485USPB-SMC-NR
- Bluetooth® Piggy Back BTPBINV-NR
- Combi-Switch DC disconnect and PV array combiner box COMBO-SWITCH
- Combiner Box Simplify wiring for added convenience and safety SBCB-6-3R or SBCB-6-4

Toll Free +1 888 4 SMA USA
www.SMA-America.com

SMA America, LLC

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PAYMENT TYPE: LEASE	INVERTER: (1) SMA # SUNNY BOY 5000–US

PREMISE OWNER: FEUERBORN, GLEN J.
7530 SE HENDERSON ST
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5037712280

AHJ: Portland

DESCRIPTION:
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5.28kW ROOF MOUNTED PV ARRAY

PAGE NAME:
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DESIGN: RASOR

SHEET: PV 10 REV: DATE: 7/18/2012

City of Portland REVIEWED FOR CODE COMPLIANCE AUG 2 2012 BUILDING DIVISION

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MOUNTING HARDWARE

Yeti with Eco-Fasten GreenFasten Flashing

The SolarCity Yeti with Eco-Fasten GreenFasten flashing optimizes strength, performance and aesthetics while structurally attaching solar panels to composition shingle roofs. This engineered connection uses Eco-Fasten's patented, IAPMO-certified "green fasten" technology to achieve a watertight seal. 6000 series aluminum offers superb structural and fatigue strength, which in conjunction with anodization offers excellent corrosion resistance even in coastal environments.

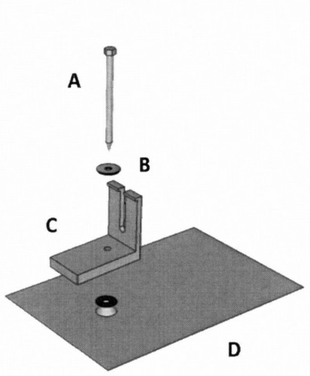
- IAPMO-ES-certified for waterproofing – Tested to ICC ac286
- Tested in accordance with UL 441 – Waterproofing for rooftop penetrations
- Anodized for long term corrosion resistance and best aesthetics
- No shingle cutting required
- Fast and error-proof installation reduces overall impact on roof
- Compatible with SolarCity Canopy Rail
- Rail is attached using Stainless Steel Fasteners

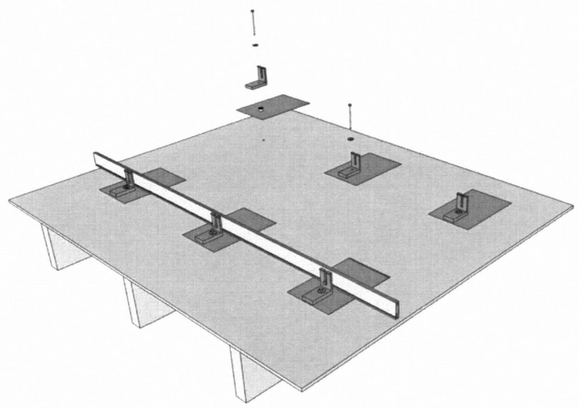
Components

A. 5/16" Lag Screw
B. Stainless Steel + EPDM Sealing Washer
C. Yeti (L-foot)
D. Eco-Fasten GreenFasten Flashing

Installation Instructions

1. Drill pilot hole in rafter
2. Seal pilot hole with roofing sealant
3. Insert Eco-Fasten flashing under upper layer of shingle
4. Place SolarCity Yeti
5. Install lag with sealing washer





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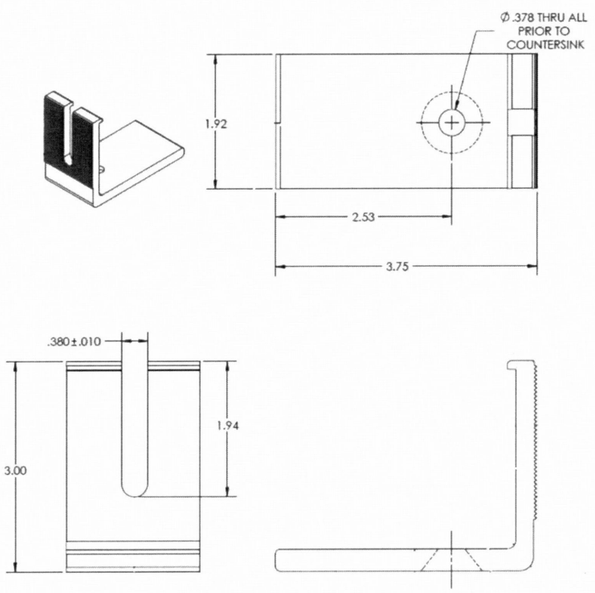
Yeti with Eco-Fasten GreenFasten Flashing



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