BLOCK 1170.07 LOT 6 QUALIFICATION CODE _____ ADDRESS (SITE) 151 Walter Road PERMIT NO. 11-2791

BRICK 1507

RECD AUG 02 2011

CONSTRUCTION PERMIT APPLICATION

C-11-002870

Applicant Completes: Sections I, II, III (optional), IV, VI, and VII

I. IDENTIFICATION

1. Proposed Work Site at: 151 Walter Road Brick, NJ 08724
2. Name of Owner in Fee: Dunst, Sherri
   Tel. ([redacted] e-mail _____
   Address Same (street) (municipality) (zip code)
3. Ownership in Fee: Public _____ Private ✓
4. Principal Contractor: Trinity Heating & Air DBA Trinity Solar Tel. (732) 780-3779
   Address 800 US Hwy 9 South e-mail TrinityHNA@aol.com
   Freehold, NJ 07728
   License No. OR, if new home, Builder Reg. No. 13VH01244300 Exp. Date 12-31-11
   Home Improvement Contractor Registration No. or Exemption Reason (if applicable): _____
   Federal Emp. ID No. 223292324 FAX: (732) 780-6671
5. Architect or Engineer _____ Contact _____
   Address _____ e-mail _____
   Tel. ( ) _____ FAX: ( ) _____
6. Responsible Person in Charge once Work has Begun Kevin Kura
   Tel. (732) 780-3779 FAX: (732) 780-6671

V. FEE SUMMARY (for office use only)

		Update	Update
1. Building	$ 75 ✓		
2. Electrical	200 ✓		
3. Plumbing			
4. Fire Protection			
5. Elevator Devices			
6. Subtotal			
7. Less 20% for State Plan Review	$		
8. Subtotal	$		
9. State Permit Surcharge Fee	49		
10. Subtotal	$		
11. Cert. of Occupancy			
12. Other	324		
13. TOTAL	$		

VI. BUILDING/SITE CHARACTERISTICS

(office use only)

1. Number of Stories _____
2. Height of Structure _____ ft.
3. Area — Largest Floor _____ sq. ft.
4. New Building Area _____ sq. ft.
5. Volume of New Structure _____ cu. ft.
6. Max. Live Load _____
7. Max. Occupancy Load _____
8. If Industrialized Building: State Approved ____ HUD ____
9. Total Land Area Disturbed _____ sq. ft.
10. Flood Hazard Zone _____
11. Base Flood Elevation _____ ft.
12. Wetlands yes ____ no ____

IIa. PROPOSED WORK

☐ Minor Work ☐ New Building ☐ Addition ☐ Demolition
☐ Repair ☐ Alteration ☐ Renovation ☐ Reconstruction
☐ Asbestos Abat. -Subch. 8 ☐ Lead Hazard Abatement ☐ Radon Remediation ☐ Annual Permit

IIb. SUBCODES (Check all that apply)

FOR OFFICE USE ONLY (Optional)

	Est. Cost	Plans Rec'd by	Date Rec'd	Rejection Date	Approval Date	Re-viewer	Resubmission Dates Approval	Resubmission Dates Rejection	Re-viewer
☑ Building	2,056		8-8-11	8/11/11			8-25-11		JW
☑ Electrical	27,319				8/16/11	JT			
☐ Plumbing									
☐ Fire Protection									
☐ Elevator		Eng.	Exempt		8/11/11	ECC			
TOTAL COST	29,375								

VII. DESCRIPTION OF BUILDING USE

A. RESIDENTIAL *(primary use)*
1. State Specific Use:
2. Use Group, Proposed: _____
3. Change in Use Group, Indicate Present:
4. No. of dwelling units: *Total Units* *Income-restricted*
   Gained, Sale _____ _____
   Gained, Rental _____ _____
   Lost, Sale _____ _____
   Lost, Rental _____ _____

B. NON-RESIDENTIAL *(primary use)*
1. State Specific Use:
2. Use Group, Proposed: _____
3. Change in Use Group, Indicate Present:

C. MIXED USE -List secondary use(s): _____

D. Construct. Classification: Present _____
Proposed _____

III. PLAN REVIEW (optional)

DO YOU WANT:
1. ☐ Partial Releases
2. ☐ Prototype Processing

IV. DOES OR WILL YOUR BUILDING CONTAIN ANY OF THE FOLLOWING?

1. ☐ Elevators/Escalators/Lifts/ Dumbwaiters/Moving Walks
2. ☐ High Pressure Boilers
3. ☐ Pressure Vessels
4. ☐ Refrigeration Systems
5. ☐ Cross-Connections/Backflow Preventers
6. ☐ Hazardous Uses/Places of Assembly
7. ☐ Sprinklers/Standpipes
8. ☐ Smoke Control Systems in Open Wells
9. ☐ Underground Storage Tanks
10. ☐ Swimming Pools, Spas and Hot Tubs
11. ☐ LPGas Tanks
12. ☐ Fire Alarm

CERTIFICATION IN LIEU OF OATH

I. OWNER SECTION (to be completed if the applicant is the owner in fee)

I hereby certify that I am the owner in fee of the property listed on Page 1.

Mark the following applicable boxes:

A. ( ) I further certify that a new home (private residence) will be constructed on this property for my own use and occupancy. This dwelling is to be occupied by myself and is not to be used for any purpose other than single family residential use. I attest that all construction, plumbing, or electrical work will be done, in whole or in part, by me or by subcontractors under my supervision, in accordance with all applicable laws; and, I further acknowledge that said new home is not covered under the New Home Warranty and Builders Registration Act (N.J.S.A. 46:3B-1 et seq.) and that such fact shall be disclosed to any person purchasing this property within ten years of the date of issuance of a certificate of occupancy.

I UNDERSTAND THAT IN MARKING BOX A, I ACKNOWLEDGE THAT I AM ASSUMING RESPONSIBILITY FOR THE WORK DONE ON SAID PROPERTY, THE CONDITION OF THE PROPERTY PRIOR TO, DURING, AND AFTER ANY WORK PERFORMED, AND FOR THE PERFORMANCE OF THE SUBCONTRACTORS I HIRE, EMPLOY, OR OTHERWISE CONTRACT OR WITH WHOM I MAKE AGREEMENTS TO PERFORM WORK. I AM VOLUNTARILY AND KNOWINGLY ASSUMING THIS RESPONSIBILITY.

B. ( ) I further certify the following as required by the New Jersey Uniform Construction Code, N.J.A.C. 5:23-2.15(f)1.ix:

I personally prepared the plans submitted for: 1) the new home referred to in A.; or, 2) an addition, alteration, renovation, or repair to an existing single family residence owned and occupied by myself and located on the property listed on Page 1; or, 3) a new structure that will be physically separate from, but that will be deemed part of, an existing single family residence that is owned and occupied by myself and located on the property listed on Page 1.

C. ( ) I further certify that I will perform or supervise the following work:
C.1. ( ) Building C.2. ( ) Fire Protection

I further certify that I will perform the following work:
C.3. ( ) Electrical C.4. ( ) Plumbing

D. ( ) I agree to advise all contractors on this project that they are required to be registered with the New Jersey Division of Taxation and to comply with all New Jersey tax laws.

I further certify the following as required by the Uniform Construction Code, N.J.A.C. 5:23-2.15(a)5: All required State, county, and local prior approvals have been given, including such certification as the construction official may require.

I understand that if any of the above statements are willfully false, I am subject to punishment.

Signature _____ Date _____

II. AGENT SECTION (to be completed if the applicant is not the owner in fee)

I hereby certify the following as required by the Uniform Construction Code, N.J.A.C. 5:23-2.15(d): the proposed work is authorized by the owner in fee; and I have been authorized by the owner in fee to make this application as his agent.

I further certify the following as required by the Uniform Construction Code, N.J.A.C. 5:23-2.15(a)5: All required State, county, and local prior approvals have been given, including such certification as the construction official may require.

I agree to advise all contractors on this project that they are required to be registered with the New Jersey Division of Taxation and to comply with all New Jersey tax laws.

I understand that if any of the above statements are willfully false, I am subject to punishment.

(✓) Check if contractor.

Agent Name Trinity Heating & Air DBA Trinity Solar

Address 800 US Hwy 9 South

Freehold, NJ 07728

Telephone (732) 780-3779

Signature _____

III. ( ) LEAD HAZARD ABATEMENT: Include Homeowner or Building Owner Affidavit as per N.J.A.C. 5:17.

Brick Township
401 Chambersbridge Rd
Brick, NJ 08723

Date Issued 11/09/2011
Control Number C-11-002870
Permit Number 11-2791
Permit Issue Date 09/15/2011
Certificate Number 11-2791

Certificate

Construction Code Division

(Certificate of Approval)

Identification

Work Site Location: 151 WALTER RD. Brick Township, NJ Block: 1170.07 Lot: 6 Qual:

Owner in Fee: DUNST, SHERRI

Owner Address: 151 WALTER RD BRICK NJ 08724

Telephone:

Contractor TRINITY HEATING AND AIR INC.

Address 800 ROUTE 9 SOUTH FREEHOLD NJ 07728

Telephone: (732) 780-3779 Fax: 732-780-6671

License Number or Builders Registration Number: 4993C 13VH01244300 Federal Emp. Number: 22-3297324

Home Warranty Number:

Type of Warranty Plan: ☐ State ☐ Private

Use Group: R-5 Construction Classification:

Maximum Live Load: 0 Maximum Occupancy Load: 0

Description of Work/Use: SOLAR PANELS

Certificate Comments:

☐ **Certificate of Occupancy**
This serves notice that said building or structure has been constructed in accordance with the New Jersey Uniform Construction Code and is approved for occupancy.

☑ **Certificate of Approval**
This serves notice that the work completed has been constructed or installed in accordance with the New Jersey Uniform Construction Code and is approved. If the permit was issued for minor work, this certificate was based upon what was visible at the time of inspection.

☐ **Certificate of Continued Occupancy**
This serves notice that based on a general inspection of the visible parts of the building there are no imminent hazards and the building is approved for continued occupancy.

☐ **Temporary Certificate of Compliance**
The following conditions must be met no later than
or the owner will be subject to fine or order to vacate:
This certificate has an expiration date of:
Conditions to be met:

☐ **Certificate of Clearance - Lead Abatement 5:17**
This serves notice that based on written certification, lead abatement was performed as per NJAC5:17 to the following extent.

☐ Total removal of lead-based paint hazards in scope of work
☐ Partial or limited time period (years); see file

☐ **Certificate of Clearance - Asbestos Abatement**
This serves notice that based on written certification, asbestos abatement was performed to the following extent.

☐ Total removal of asbestos hazards in scope of work
☐ Partial or limited time period (years); see file

☐ **Certificate of Compliance**
This serves notice that said potentially hazardous equipment has been installed and/or maintained in accordance with the New Jersey Uniform Construction Code and is approved for use until

☐ **Temporary Certificate of Occupancy**
The following conditions must be met no later than:
or the owner will be subject to fine or order to vacate:
This certificate has an expiration date of:
Conditions to be met:

David J. Newman Jr

Construction Official

Fee: $0.00
Check Number:
Collected By:

Date Printed: 11/09/2011 U.C.C. F260 (rev. 08/05)

8/30/11 called cont. put - LM

CONSTRUCTION PERMIT

NEW JERSEY UNIFORM CONSTRUCTION CODE

Date Issued 9/15/11
Control # C-11-002870
Permit # 11-2791

IDENTIFICATION Block: 1170.07 Lot: 6 Qualifier

Work Site Location: 151 WALTER RD. Brick Township, NJ

Contractor: TRINITY HEATING AND AIR INC.
Address: 800 ROUTE 9 SOUTH FREEHOLD NJ 07728

Owner in Fee: DUNST, SHERRI
151 WALTER RD BRICK NJ 08724

Telephone: (732) 780-3779
Lic. No. or Bldrs. Reg. No. 13VH01244300
Federal Employee. No. 22-3297324

Telephone:

Is hereby granted permission to perform the following work:

- [x] BUILDING
- [ ] PLUMBING
- [ ] LEAD HAZARD ABATEMENT
- [x] ELECTRICAL
- [ ] FIRE PROTECTION
- [ ] DEMOLITION
- [ ] ELEVATOR DEVICES
- [ ] ASBESTOS ABATEMENT (Subchapter 8 only)
- [ ] OTHER

DESCRIPTION OF WORK:

SOLAR PANELS

PAYMENTS (Office Use Only)

Building	$75
Electrical	$200
Plumbing	$0
Fire Protection	$0
Elevator Devices	$0
Other	$0.00
DCA Training Fee	$49
CO Fee	
Other	$0
Total	$324
Check No.	17550
Cash	$0
Credit	$0
Collected By	

+50
374

Note: If constuction does not commence within one (1) year of date of issuance, or if construction ceases for a period of six (6) months, this permit is void.

Estimated Cost of Work $29,375

Construction Official Date 8-29-11

U.C.C. F170
equiv (rev 8/03)

1 WHITE - INSPECTOR 2 CANARY - OFFICE 3 PINK - TAX ASSESSOR 4 GOLD - APPLICANT

REQUIRED INSPECTIONS

Construction work must be inspected in accordance with the State Uniform Construction Code Regulations N.J.A.C. 5:23-2.18. This agency will carry out such periodic inspections during the progress of work as are necessary to insure that the work installed conforms with the requirements of the Uniform Construction Code.

The owner or other responsible person in charge of work must notify this agency when work is ready for any required inspections specified below. Requests for inspections must be made at least 24 hours prior to the time the inspection is desired. Inspections will be performed within three business days of the time for which they are requested. The work must not proceed in a manner which will preclude the inspection until it has been made and approval granted.

- [ ] Required inspections for all subcodes for one- and two-family dwellings are as follows:

1. The bottom of footing trenches before placement of footings, except that in cases of pile foundations, inspections shall be made in accordance with the requirements of the building subcode.
2. Foundations and all walls up to grade level prior to back filling.
3. All structural framing, connections, wall and roof sheathing and insulation; electrical rough wiring, panel and service installation; rough plumbing. The framing inspection shall take place after the rough electrical and plumbing inspections and after the installation of the heating, ventilation and /or air conditioning duct system. The insulation inspection shall be performed after all other subcode rough inspections and prior to the installation of any interior finish material.
4. Installation of all finished materials, sealings of exterior joints, plumbing piping, trim and fixtures; electrical wiring, devices and fixtures; mechanical systems equipment.

#2791
ELECTRI 200.00
DCA 49.00
324.00

Additional required inspections for all subcodes of construction, for other than one- and two-family dwellings, are fire suppression systems, heat producing devices and Barrier Free subcode accessibility, if applicable.

- [x] Required special inspections. The applicant by accepting the permit will be deemed to have consented to these requirements:
  contractor must be on site with ladder for inspections
  rough electric and building inspections must be scheduled
  a final electric inspection must be completed
- [x] A final inspection is required for each applicable subcode area before a final Certificate of Occupancy or Approval may be issued. The final inspections include the installation of all interior and exterior finish materials, sealing of exterior joints, mechanical system and other required equipment; electrical wiring, devices and fixtures; plumbing pipes, trim and fixtures; tests required by any provision of the adopted subcodes; Barrier Free accessibility, if applicable; and verification of compliance with NJAC 5:23-3.5, "Posting structures".
- [x] A complete copy of released plans must be kept on the job site.

If you do not understand any of this information, please ask.

TRINITY SOLAR

17552

Township of Brick

9/14/2011

374.00

Herald Bank

Dunst: Block 1170.07 Lot 6

374.00

BUILDING SUBCODE
TECHNICAL SECTION

Date Received / Control # 9/14/11

Date Issued / Permit # 11-2791

A. IDENTIFICATION—APPLICANT: COMPLETE ALL APPLICABLE INFORMATION. WHEN CHANGING CONTRACTORS, NOTIFY THIS OFFICE. CALL UTILITY DIG NO: 1-800-272-1000.

Block 1170.07 Lot 6 Qualification Code

Work Site Location 151 Walter Road
Brick, NJ 08724

Owner in Fee: Dunst

Tel. [redacted] e-mail

Address Same
street municipality zip code

Contractor: Trinity Heating & Air DBA Trinity Solar Tel. (732) 780-3779

Address 800 US Hwy 9 South e-mail TrinityHNA@aol.com
Freehold, NJ 07728

Contractor License No. or Builder Registration No. 13VH01244300 Exp. Date 12-31-11

Home Improvement Contractor Registration No. or Exemption Reason (if applicable):

Federal Emp. ID No. 223292324 FAX: (732) 780-6671

JOB SUMMARY (Office Use Only)

PLAN REVIEW	Date	Initial
[ ] No Plans Required		
[✓] All	8-25-11	JM
[ ] Footings/Foundations		
[ ] Structural/Framework		
[ ] Exterior		
[ ] Interior		

Joint Plan Review Required:
[ ] Elec. [ ] Plumb. [ ] Fire [ ] Elevator

SUBCODE APPROVAL for PERMIT
Date:
Approved by:

SUBCODE APPROVAL for CERTIFICATE
[ ] CO [ ] TCO [X] CA
Date: 11/9/11
Approved by: JM

INSPECTIONS Type:	Failure	Failure	Approval	Initial
	Dates (Month/Day)			
Footing				
Footing Bonding				
Foundation				
Slab				
Frame				
Truss Sys./Bracing				
Barrier-Free				
Insulation				
Finishes -Base Layer				
Finishes -Final				
Energy				
Mechanical				
TCO				
Other				
Final *	10/6/11 MW		11-2-11	MW
Barrier-Free				

B. BUILDING CHARACTERISTICS

Use Group Present Proposed

No. of Stories

Height of Structure ft.

Area — Largest Floor sq. ft.

New Bldg. Area/All Floors sq. ft.

Volume of New Structure cu. ft.

Max. Live Load

Max. Occupancy Load

Constr. Class Present Proposed

If Industrialized Building:
State Approved HUD

Est. Cost of Bldg. Work:
1. New Bldg. $
2. Rehabilitation $
3. Total (1+ 2) $ 2,050

U.C.C. F110 (rev. 11/09)

A No Plans

C. CERTIFICATION IN LIEU OF OATH

I hereby certify that I am the (agent of) owner of record and am authorized to make this application.

Sign here:

Print name here: Thomas Pollock

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK
Install rackings for solar panels on roof

TYPE OF WORK:
[ ] New Building
[ ] Addition
[ ] Rehabilitation
[ ] Roofing
[ ] Siding
[ ] Fence Height (exceeds 6')
[ ] Sign Sq. Ft.
[ ] Pool
[ ] Retaining Wall Sq. Ft.
[ ] Asbestos Abatement Subchapter 8
[ ] Lead Haz. Abatement NJAC 5:17
[ ] Radon Remediation
[X] Other Rackings
[ ] Demolition

FEE (Office Use Only)
$

Administrative Surcharge $
Minimum Fee $
State Permit Surcharge Fee $
TOTAL FEE $

B #1170.07
C # 6
P# 11-2791
TRINITY – #732-780-3779

Optimize Engineering Co., LLC

P.O. Box 264•Farmville•VA 23901
Ph: 434.574.6138•E-mail: grichardpe@aol.com

TOWNSHIP OF BRICK

RELEASED FOR PERMIT	INITIAL	DATE
Building Subcode	JCL	8-25-11
Fire Subcode		
Electrical Subcode		
Plan Reviewer		
Plans Released		
Construction Official		

Richard B. Gordon, P.E.
President

July 26, 2011

Brick Building Department
Brick, NJ

Re: Solar Electric Panels Roof Structural Framing Support

To Whom It May Concern:

I hereby certify that I am a Licensed Professional Engineer in the State of New Jersey. Please note the following conclusions regarding framing structure, roof loading, and photovoltaic system size and proposed site location of installation:

1. Existing roof framing: Conventional framing 2x6 16" o.c. 11'-11" & 9' span (horizontal rafter projection). This existing structure is definitely capable to support all of the loads that are indicated below for this photovoltaic project.
2. Roof Loading
   - 4.33 psf dead load (modules plus all mounting hardware)
   - 21 psf snow live load (30 psf ground snow live load reference)
   - Exposure Category B, 115 mph wind uplift live load of 19.6 psf (wind resistance)
3. Solar Photovoltaic System size: 5.875 kw Solar Electric 25 Trina Modules of 235 Watt capacity each module.
4. Address of proposed installation: Residence of Sherri Dunst, 151 Walter Road, Brick, NJ

This installation design will be in general conformance to the manufacturer's specifications, and is in compliance with all applicable laws, codes, and ordinances, and specifically N.J.A.C. 5:23-6 (Rehabilitation Subcode), International Residential Code/ IRC 2009 NJ Edition, N.J.A.C. 5:23-3.21, 2008 NEC, and NJ 2009 ICC Energy Code. The spacing of the UniRac mounting brackets ANCHORAGE/FASTENING of the brackets is at a maximum of 64" o.c. along the rail and using 5/16" x 3 ½" length lag bolts min. 2" penetration, which is adequate to resist all 115 mph wind live loads including wind shear, to mount rails to rafters while alternating mounting feet between adjacent rafters between rail rows for better distribution of roof load. Rails may be attached to either of two mounting holes in the L-feet. Mounting in the lower hole for a low profile, more aesthetically pleasing installation or mount in the upper hole for a higher profile to maximize airflow under the modules to cool them more. Slide the 3/8-inch mounting bolts into the footing bolt slots. The rails will be attached to the footings with the flange nuts.

Very truly yours,
Optimize Engineering Co., LLC

Richard B. Gordon, P.E.
New Jersey P.E. License No. 29483

STATE OF NEW JERSEY
RICHARD B. GORDON
No. GE29483
LICENSED
PROFESSIONAL ENGINEER

ELECTRICAL SUBCODE
TECHNICAL SECTION

Date Received 9/14/11
Control #
Date Issued
Permit # 11-2791

A. IDENTIFICATION—APPLICANT: COMPLETE ALL APPLICABLE INFORMATION. WHEN CHANGING CONTRACTORS, NOTIFY THIS OFFICE. CALL UTILITY DIG NO: 1-800-272-1000.

Block 1170.07 Lot 6 Qualification Code

Work Site Location 151 Walter Road
Brick, NJ 08724

Owner in Fee: Dunst

Tel. [redacted] e-mail

Address Same
street municipality zip code

Contractor: Trinity Heating & Air DBA Trinity Solar Tel. (732) 780-3779

Address 800 US Hwy 9 South e-mail TrinityHNA@aol.com
Freehold, NJ 07728

Contractor License No. 4993C Exp. Date 3-31-12

Home Improvement Contractor Registration No. or Exemption Reason (if applicable):

Federal Emp. ID No. 223292324 FAX: (732) 780-6671

B. ELECTRICAL CHARACTERISTICS

Use Group Present Proposed

[ ] Pole/Pad # [ ] Temporary [ ] Other

Building Occupied as Utility Co.

Est. Cost of Elec. Work $ 27,319

JOB SUMMARY (Office Use Only)

PLAN REVIEW

[ ] No Plans Required

[ ] Partial -Underslab Utilities Approved
Date: Approved by:

[✓] Electric Plans Approved
Date: 9/16/11 Approved by: W

Joint Plan Review Required:
[ ] Bldg. [ ] Plumb. [ ] Fire. [ ] Elev.

SUBCODE APPROVAL for PERMIT
Date: 9/16/11
Approved by: W

SUBCODE APPROVAL for CERTIFICATE
[ ] CO [ ] CCO [ ] CA
Date: 10/11/11
Approved by: D

INSPECTIONS Type:	Dates (Month/Day) Failure	Failure	Approval	Initial
Rough	R/I-Bump		9-19-11	DD
Barrier-Free				
Trench				
Temp. Serv.				
Constr. Serv.				
TCO				
Other				
Service			10-6-11	DD
Final				
Barrier-Free				
Temp. Cut-in-Card Date Issued				
Final Cut-in-Card Date Issued				
Annual Pool Inspection				
Date of Grounding and Bonding Certification				

C. CERTIFICATION IN LIEU OF OATH

I hereby certify that I am the (agent of) owner of record and am authorized to make this application and perform the work listed on this application.

Applicant sign/Contractor sign and seal here: Ralph Perrone

Print name here: Ralph Perrone

[✓] Licensed Elec. Contractor [ ] Certif'd Landscape Irrigation Cont'r [ ] Exempt Applicant

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK: Install inverters and solar panels on roof

QTY.	SIZE	ITEMS	FEE (Office Use Only)
		Lighting Fixtures	
		Receptacles	
		Switches	
		Detectors	
		Light Poles	
		Motors—Fract. HP	
		Emergency & Exit Lights	
		Communications Points	
		Alarm Devices/F.A.C. Panel	
		TOTAL NUMBERS	$
		Pool Permit/with UW Lights	
		Storable Pool/Spa/Hot Tub	
		KW Elec. Range/Receptacle	
		KW Oven/Surface Unit	
		KW Elec. Water Heater	
		KW Elec. Dryer/Receptacle	
		KW Dishwasher	
		HP Garbage Disposal	
		KW Central A/C Unit	
		HP/KW Space Heater/Air Handler	
		KW Baseboard Heat	
		HP Motors 1/+ HP	
		KW Transformer/Generator	
		AMP Service	
1	100A	AMP Subpanels	
1	8.3A	AMP Motor Control Center/Inverter	
1	14.5A	~~KW Elec. Sign/Outline Light~~ Inverter	
1	5.875	PV System	
1	30A	D. Conn.	

Administrative Surcharge	$
Minimum Fee	$
State Permit Surcharge Fee	$
TOTAL FEE	$

Applicant: When submitting this form to your Local Construction Code Enforcement Office, please provide one original plus three photocopies.

RECEIVING CLERK _____
DATE REC'D 8-8-11

ZONING PERMIT APPLICATION

PERMIT # ZP-11-00828
DATE ISSUED 9/15/11

BLOCK: 1170.07 LOT: 6 QUALIFIER: _____ SITE ADDRESS: 151 Walter Road

IDENTIFICATION:

1. NAME OF OWNER IN FEE: Sherri Dunst
   COMPLETE ADDRESS: 151 Walter Road
   Brick NJ 08724
   PHONE # [redacted] EMAIL: _____

2. NAME OF APPLICANT: Trinity Solar (Thomas Pollock)
   APPLICANT ADDRESS: 800 U.S. Hwy 9 South
   Freehold, NJ 07728
   PHONE # (732) 780-3779 EMAIL: _____

3. RESPONSIBLE PERSON FOR WORK: Kevin Kura
   PHONE# (732) 780-3779 FAX# (732) 780-0671

4. SIGNATURE OF APPLICANT: Thomas Pollock

FOR OFFICE USE ONLY

FEE SUMMARY:

APPLICATION FEE: $ 50 ✓
OTHER: $ _____
TOTAL: $ _____

REQUIRED BY APPLICANT

RESIDENTIAL: SFR R-15
COMMERCIAL: _____
EXISTING USE: SFR
PROPOSED USE: _____

BOARD APPROVAL: ___ PB ___ ZB
RESOLUTION#: _____
APPROVAL DATE: _____

PROJECT DESCRIPTION: (PLEASE CHECK APPLICABLE WORK & DESCRIBE)
*NEW BUILDING: _____ *ADDITION _____ *ALTERATION _____ *PORCH _____ *DECK _____

POOL: ABOVE GROUND _____ IN GROUND _____ FENCE: HEIGHT _____ TYPE _____

HEIGHT: _____ (*IF APPLICABLE)

OTHER install solar panels

DESCRIPTION: install 5.875 kw solar panels flat on roof; not to exceed roof panels, but will add 10" to roof height. 25 panels

ZONING REVIEW:
DATE REVIEWED: 8/9/11 DATE DENIED: _____ DATE APPROVED: 8/9/11 INTLS: JPP

(SEE BACK PAGE)

TOWNSHIP OF BRICK ZONING CHECKLIST

1) **Two (2) copies of plot plan containing:**

- All existing and proposed structures
- All dimensions of the lot and structures
- All setbacks from the structures to the property lines
- All adjacent streets and waterways
- If applicable, include a copy of the Zoning Board of Adjustment Resolution, the date that the map was signed, and/or the date that the subdivision map was filed with the Ocean County Clerk, along with the file map and number.

2) **Two copies of the plans with dimensions and heights noted:**

- Floor plans and elevations
- Signed site plans
- Property map
- Survey map

Choose which is applicable for submission

3) **Plot plans and building plans must match for complete review**

NOTE: NO PARTIAL, TAPED, FAXED, REDUCED OR ENLARGED COPIES CAN BE ACCEPTED

01/2010

245 Attachment 5

Township of Brick

SCHEDULE OF AREA, YARD AND BUILDING REQUIREMENTS
Township of Brick
Ocean County, New Jersey

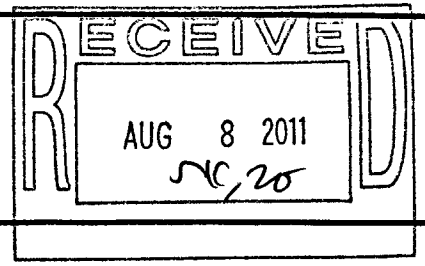
[Amended 6-26-1979 by Ord. No. 354-2B-79; 4-22-1980 by Ord. No. 354-2H-80; 10-14-1980 by Ord. No. 354-2N-80; 9-23-1980 by Ord. No. 354-1B-80; 8-25-83 by Ord. No. 354-2SS-83; 11-5-1984 by Ord. No. 354-2-AAA-84; 11-5-1984 by Ord. No. 354-2CCC-84; 6-24-1986 by Ord. No. 354-2WWW-86; 9-13-1988 by Ord. No. 354-2TTTT-88; 9-27-1988 by Ord. No. 354-2XXXX-88; 9-12-2000 by Ord. No. 354-2EE-00; 5-9-2000 by Ord. No. 354-2Z-00; 3-26-2002 by Ord. No. 354-2C-02; 11-26-2002 by Ord. No. 354-2L-02; 3-25-2003 by Ord. No. 354-2D-03; 6-13-2006 by Ord. No. 19-06]

Zone	Minimum Lot Size						Minimum Required Yard Depth						Maximum Lot Coverage by Building	Maximum Building Height				Minimum Floor/ Building Area (square feet) 2 stories/1 story	Maximum Allowable Impervious Coverage
	Interior Lots			Corner Lots			Principal Building				Accessory Building								
	Area (square feet)	Width (feet)	Depth (feet)	Area (square feet)	Width (feet)	Depth (feet)	Front Yard (feet)	Side Yard, Each (feet)	Both Sides Combined (feet)	Rear Yard (feet)	Side Yard (feet)	Rear Yard[3] (feet)		Stories	Eaves (feet)	Feet	Ridge (feet)		
R-R	40,000	150	150	40,000	150	150	50	25		50	25	25	25%	–	25			–	
RR-2	See § 245-90.																		
RR-3	See § 245-103.																		
R-20	20,000	100	125	25,000	100	125	40	15	–	40	10	10	25%	–	25	35	38.5	–	
R-15	15,000	100	115	17,250	100	115	35	12	–	35	10	10	25%	–	25	35	38.5	–	
R-10	10,000	90	100	10,500	100	100	30	6	20	20	5	5	30%	–	25	35	38.5	–	
R-7.5	7,500	75	90	9,000	75	90	25	6	15	15	5	5	30%	–	25	35	38.5	–	
R-5	5,000	50	75	6,000	50	75	20	5	12	15	5	5	35%	–	25	35	38.5	–	
O-P	15,000	100	150	15,000	100	150	50	10	–	50	20	50	35%[2]	2	–	35	38.5	1,500	70%
B-1	10,000	100	90	12,500	100	125	30	10	–	20	10	20	30%[2]	2	–	35	38.5	1,000	60%
B-2	20,000	125	125	20,000	125	125	50	10	–	50	10	50	30%[2]	2	–	35	38.5	2,000	65%
B-3	2 acres	200	200	2 acres	200	200	75	30	–	50	20	50	25%[2]	–	–	35	38.5	2,000	65%
B-4	5 acres	300	300	–	–	–	100	50(150[1])	–	100(150[1])	20	50	25%	3	–	35	38.5	30,000	70%
M-1	5 acres	300	300	5 acres	300	300	100	50	–	150	75	150	30%[2]	–	–	35	38.5	5,000	65%
R-M	25 acres	350	200	–	–	–	50	50	–	30	30	30	20%	–	25	35	38.5	–	65%
O-P-T	40,000	150	150	40,000	150	150	50	20	–	50	20	50	25%[2]	2	–	35	38.5	2,000	50%
H-S	See § 245-261.													–	–	–	–		70%

NOTES:

1. If adjacent to residential zone or use.
2. The maximum lot coverage shall refer only to that percentage of an affected lot which is suitable for building.
3. For rear yard setback requirements for accessory buildings on waterfront property, see § 245-10D.

OFFICE USE ONLY



ZONING REVIEW:

DATE REVIEWED: 8/9/11 DATE DENIED: _____ DATE APPROVED: 8/9/11 INTLS: JBP

DATE:	COMMENTS:	INITIALS:

Brick Township
401 Chambers Bridge Rd.

Brick, NJ 08723
(732) 262-1027

Date Issued: 9/15/11
Application Number: ZA-11-00871
Application Date: 08/09/2011
Project Number:
Permit Number: ZP-11-00871
Fee: $50

Zoning Permit

Worksite **151 WALTER RD.**
Location: **Brick Township, NJ**

Block: **1170.07**
Lot: **6**
Qualifier:
Zone: **R-7.5**

Owner: **DUNST, SHERRI**
Address: **151 WALTER RD**
BRICK, NJ 08724

Applicant: **Trinity Solar**
Address: **800 US Hwy 9 South**
Freehold, NJ 07728

Application Approved Date: 08/09/2011

This Certifies that an application for the issuance of a Zoning Permit has been examined.

Use is: Single-Family Residential Solar Panels
Nonconforming Use is: _____

Work Description:
Solar Panel - Installation of 25 roof mounted solar panels.

Upon review it was determined that:

- ☑ Use is permitted by Ordinance
- ☐ Use is permitted by Variance approved on: _____
- ☐ Valid Nonconforming Use is established by
  - ☐ Zoning Board of Adjustment
  - ☐ Zoning Officer

Office of Zoning

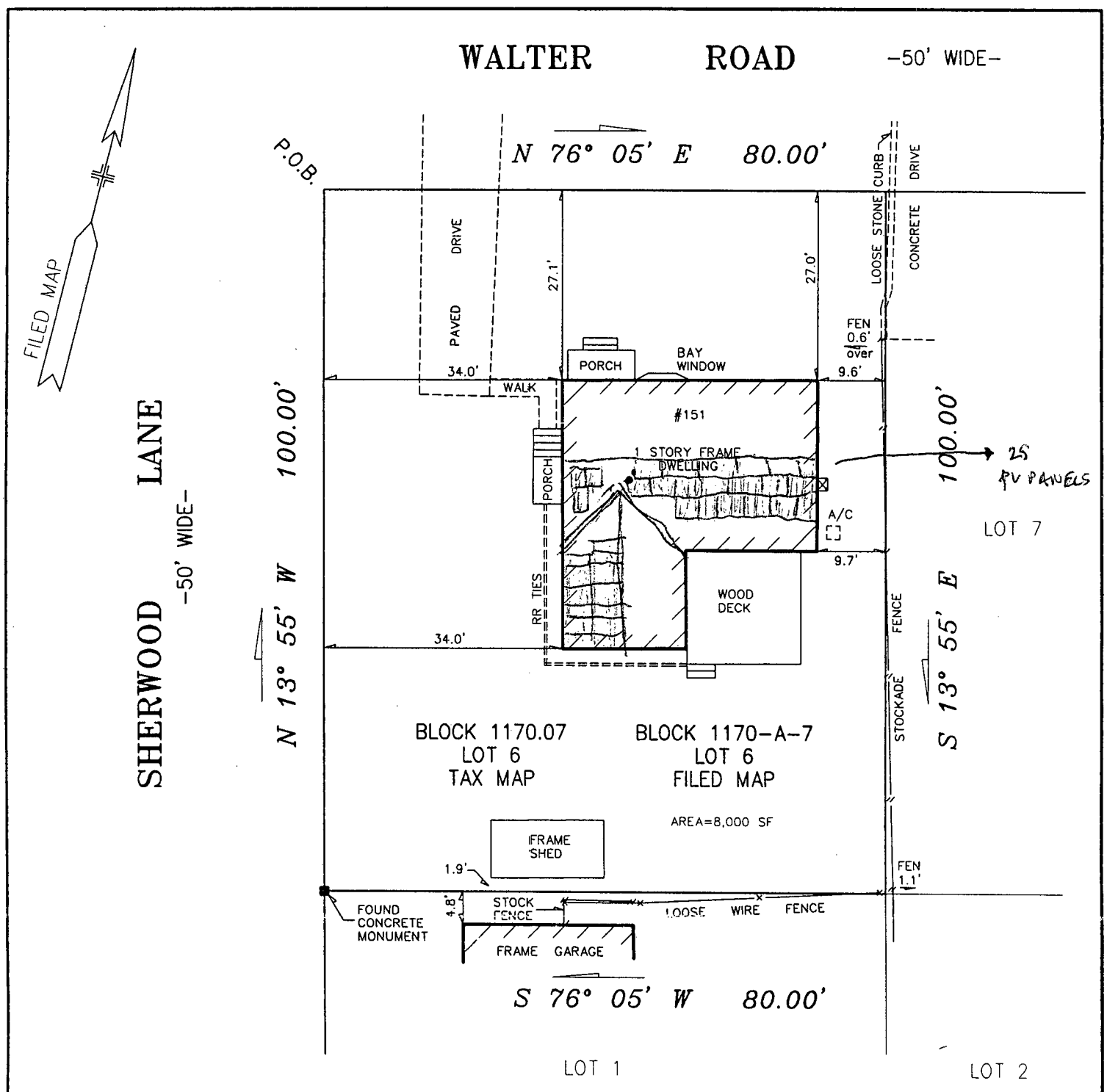
Michael P. Fowler, Township Planner

08/09/2011
Date

9/10/11
Date

09/15/11 11:52AM 001558#9152
**02 SERV.002

#2791	
ZPA	$50.00
**TOTAL	$50.00
CHECK	$50.00
CHANGE	$0.00



FILED MAP REFERENCE:

"LAUREL ACRES" FILED IN THE OCEAN COUNTY CLERK'S OFFICE JULY 2, 1957 AS MAP D-67.

NOTES:
1) THIS SURVEY IS A REPRESENTATION OF CONDITIONS EXISTING ON THE PROPERTY EXCEPT SUCH EASEMENTS AND ENCROACHMENTS, IF ANY, THAT MAY BE LOCATED BELOW THE SURFACE OF THE LAND OR NOT VISIBLE ON THE SURFACE OF THE LAND OR IN DOCUMENTATION SUPPLIED AT THE TIME OF THE SURVEY.
2) THIS SURVEY IS MADE ONLY TO THE NAMED PARTIES FOR PURCHASE AND/OR MORTGAGE OF DELINEATED PROPERTY BY NAMED PURCHASER.
3) NO RESPONSIBILITY OR LIABILITY IS ASSUMED BY THE SURVEYOR FOR USE OF SURVEY FOR ANY PURPOSE INCLUDING BUT NOT LIMITED TO USE OF SURVEY FOR SURVEY AFFIDAVIT, RESALE OF PROPERTY, CONSTRUCTION, OR ANY OTHER PERSON NOT NAMED IN CERTIFICATION, EITHER DIRECTLY OR INDIRECTLY.
4) A WRITTEN WAIVER AND DIRECTION NOT TO SET CORNER MARKERS HAS BEEN OBTAINED FROM THE ULTIMATE USER PURSUANT TO P.L. 2003, c14 (C45:8-36.3) AND N.J.A.C. 13:40-5.1(d).

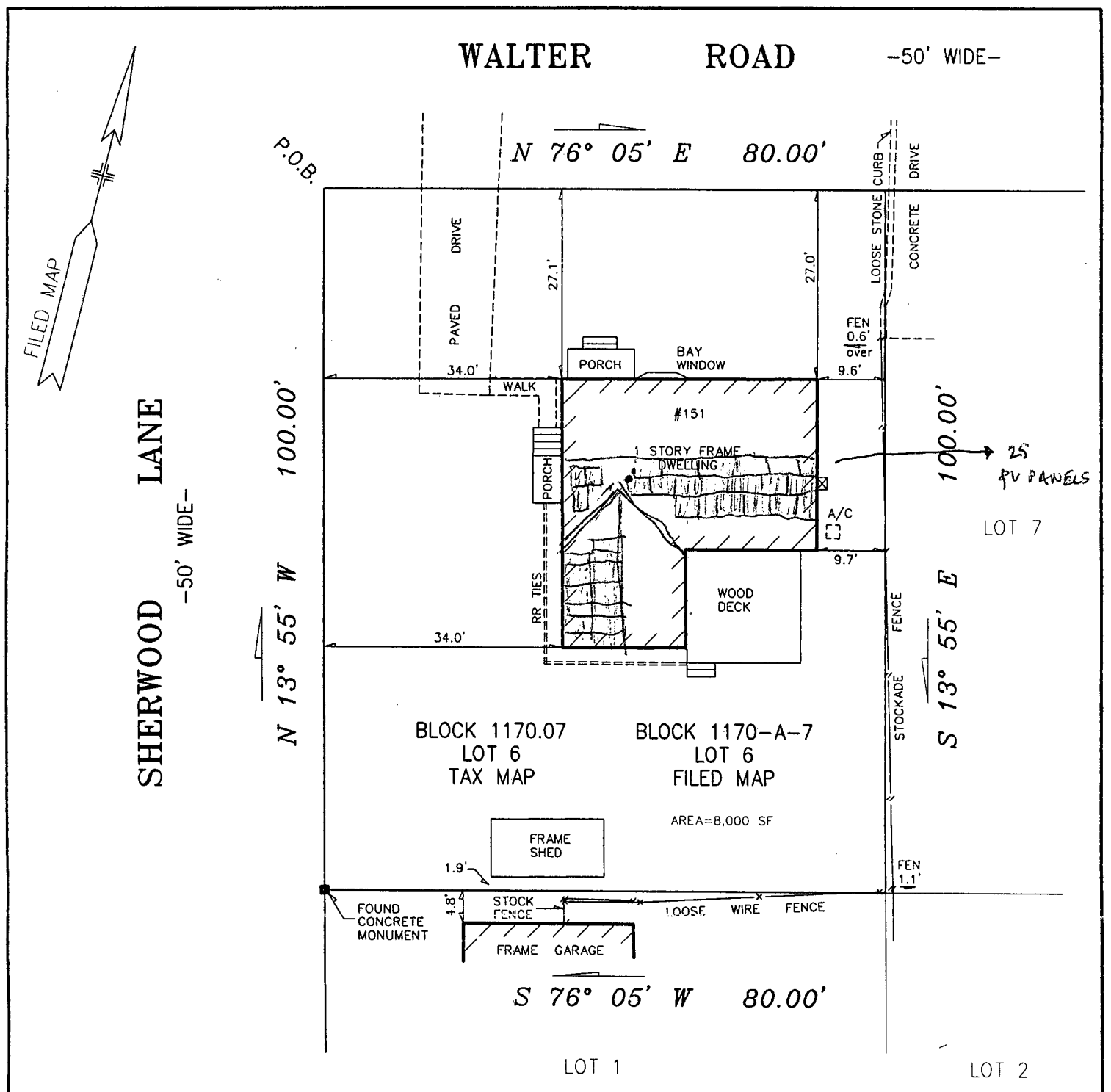
CERTIFIED TO:

SHERRI DUNST;
WEICHERT TITLE AGENCY (W-209734);
FIDELITY NATIONAL TITLE INSURANCE COMPANY;
TOYOTA FEDERAL CREDIT UNION,
ITS SUCCESSORS AND/OR ASSIGNS AS THEIR INTERESTS MAY APPEAR;
GUBERMAN & STERN, LLC,
BARRY GUBERMAN, ESQ.

DECEMBER 18, 2006
SCALE: 1"=20'
JOB 16535
FB134-58

SURVEY OF
151 WALTER ROAD
TOWNSHIP OF BRICK
OCEAN COUNTY, NEW JERSEY

DOMINICK J. VENDITTO, III
NJ LIC. PROFESSIONAL LAND SURVEYOR #30093
626 FERNWOOD TERRACE, LINDEN, NJ 07036
908-925-8828 FAX 908-925-8829



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908-925-8828 FAX 908-925-8829

B #1170.07
C # 6
P# 11-2791
TRINITY – #732-780-3779

Optimize Engineering Co., LLC

P.O. Box 264•Farmville•VA 23901
Ph: 434.574.6138•E-mail: grichardpe@aol.com

TOWNSHIP OF BRICK
RELEASED FOR PERMIT INITIAL DATE
Building Subcode JK 8-25-11
Fire Subcode
Electrical Subcode
Plan Reviewer
Plans Released
Construction Official

Richard B. Gordon, P.E.
President

July 26, 2011

Brick Building Department
Brick, NJ

Re: Solar Electric Panels Roof Structural Framing Support

To Whom It May Concern:

I hereby certify that I am a Licensed Professional Engineer in the State of New Jersey. Please note the following conclusions regarding framing structure, roof loading, and photovoltaic system size and proposed site location of installation:

1. Existing roof framing: Conventional framing 2x6 16" o.c. 11'-11" & 9' span (horizontal rafter projection). This existing structure is definitely capable to support all of the loads that are indicated below for this photovoltaic project.
2. Roof Loading
   - 4.33 psf dead load (modules plus all mounting hardware)
   - 21 psf snow live load (30 psf ground snow live load reference)
   - Exposure Category B, 115 mph wind uplift live load of 19.6 psf (wind resistance)
3. Solar Photovoltaic System size: 5.875 kw Solar Electric 25 Trina Modules of 235 Watt capacity each module.
4. Address of proposed installation: Residence of Sherri Dunst, 151 Walter Road, Brick, NJ

This installation design will be in general conformance to the manufacturer's specifications, and is in compliance with all applicable laws, codes, and ordinances, and specifically N.J.A.C. 5:23-6 (Rehabilitation Subcode), International Residential Code/ IRC 2009 NJ Edition, N.J.A.C. 5:23-3.21, 2008 NEC, and NJ 2009 ICC Energy Code. The spacing of the UniRac mounting brackets ANCHORAGE/FASTENING of the brackets is at a maximum of 64" o.c. along the rail and using 5/16" x 3 ½" length lag bolts min. 2" penetration, which is adequate to resist all 115 mph wind live loads including wind shear, to mount rails to rafters while alternating mounting feet between adjacent rafters between rail rows for better distribution of roof load. Rails may be attached to either of two mounting holes in the L-feet. Mounting in the lower hole for a low profile, more aesthetically pleasing installation or mount in the upper hole for a higher profile to maximize airflow under the modules to cool them more. Slide the 3/8-inch mounting bolts into the footing bolt slots. The rails will be attached to the footings with the flange nuts.

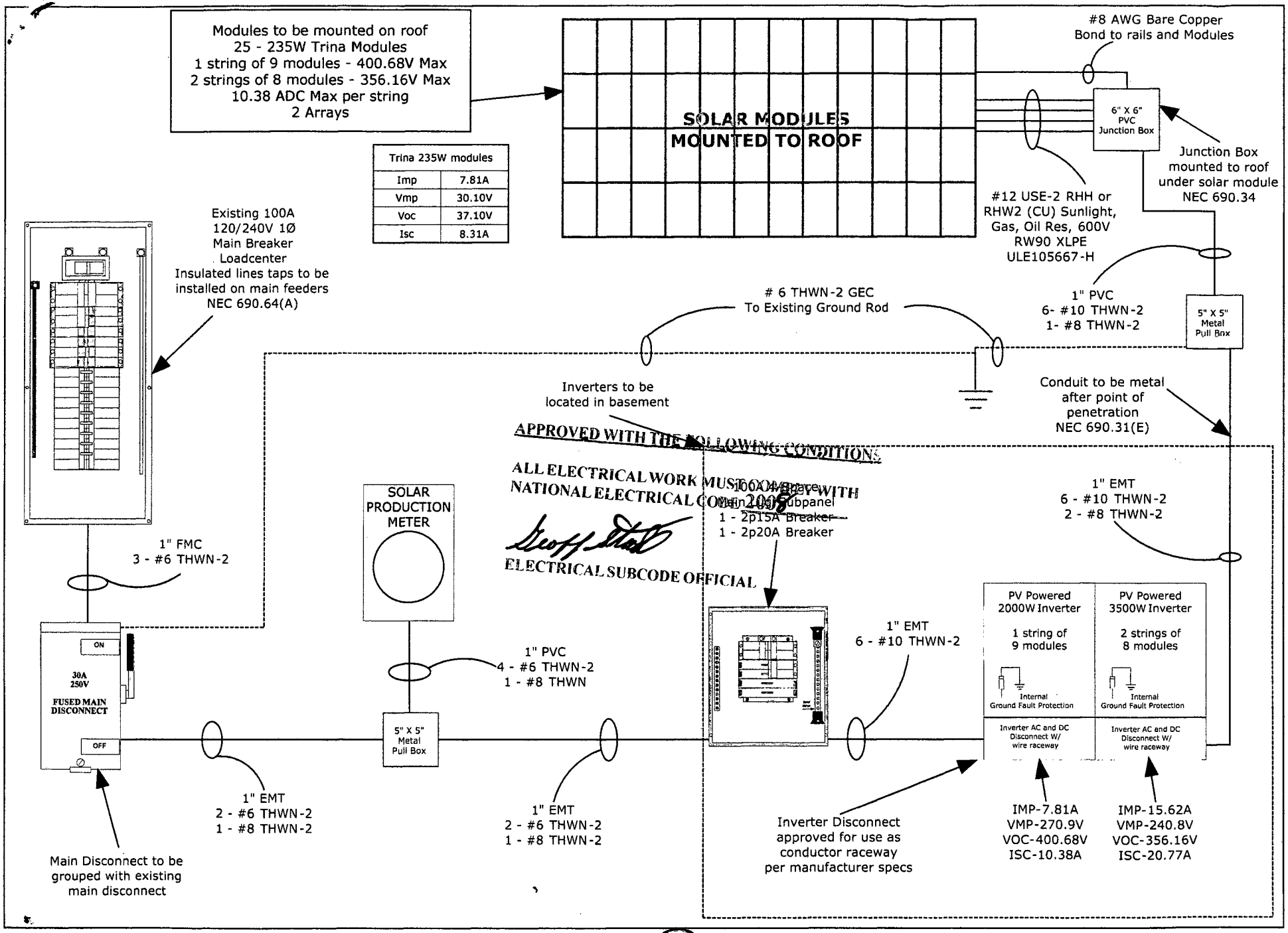
Very truly yours,
Optimize Engineering Co., LLC

Richard B. Gordon, P.E.
New Jersey P.E. License No. 29483

STATE OF NEW JERSEY
RICHARD B. GORDON
No. GE29483
LICENSED
PROFESSIONAL ENGINEER

11/2/11

Russ,
Please file this
Back in the
Jacket Thanx
Mike

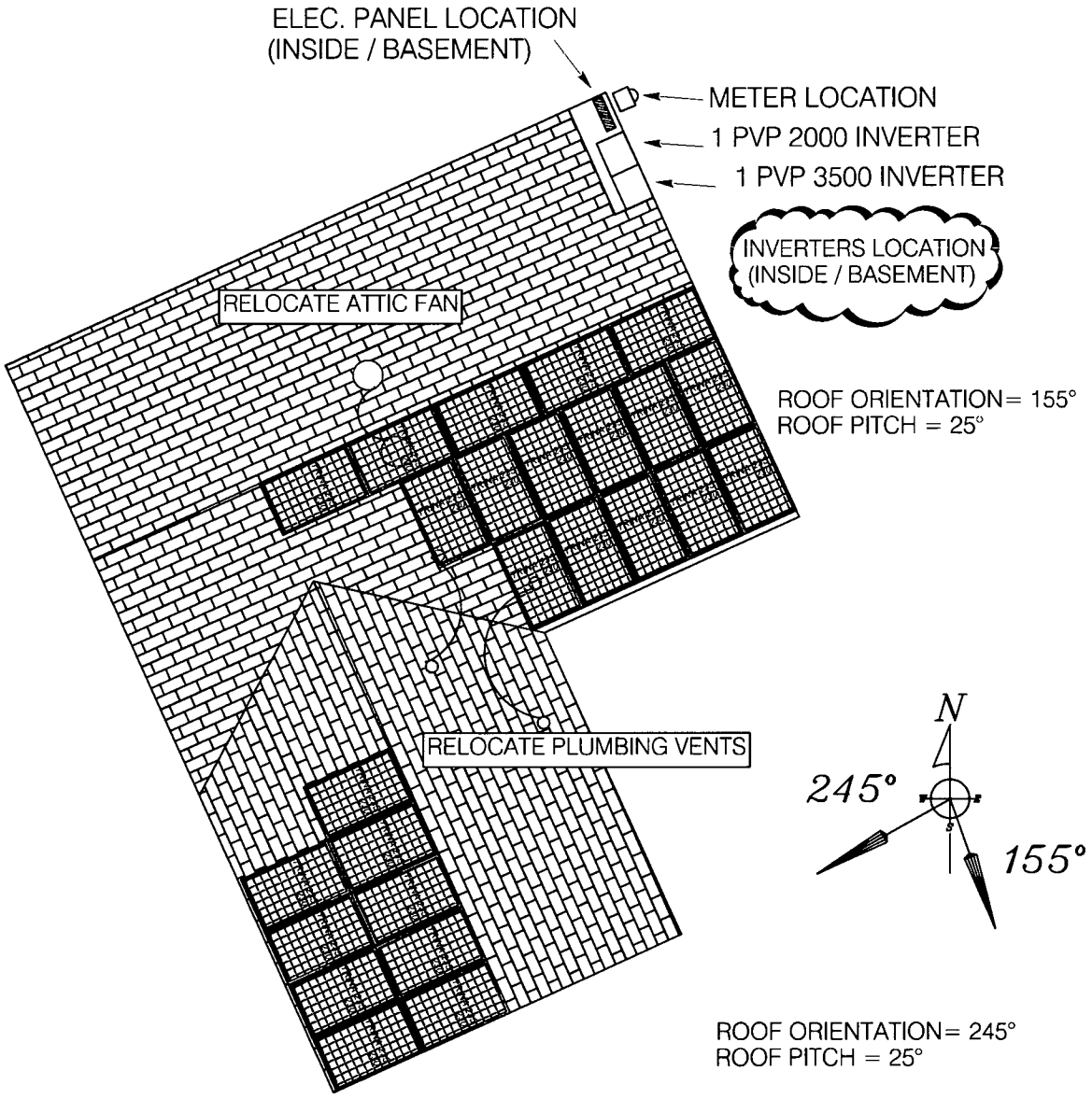


Trinity SOLAR
800 US Highway 9 South
Freehold, NJ 07728
TEL. 732-780-3779
FAX. 732-780-6671

CUSTOMER:
Sherri Dunst
151 Walter Road
Brick, NJ 08724

5.875 KW Solar System
25 - 235W Trina modules

Electrical One Line Diagram
Revision No. 00
Date: 6/8/11
Drawn By: GAP



Revisions		
No.	Description	Date

Date: 6/11/2011
Drawn By: AIS
Revised By:
Checked By:

Graphic Scale:
NOT TO SCALE

Customer Information:

SHERRI DUNST
151 WALTER ROAD

BRICK , NEW JERSEY

Drawing Title:
PROPOSED
5.875 KW SOLAR
SYSTEM

Total System Information:
JCP&L ACCT #:
10 00 69 2710 2 9
SYSTEM SIZE: 5.875 kW
MODULES: TRINA 235
OF MODULES: 25

Rev. No.
0

Sheet:
1/1

Trinity™ SOLAR
800 US Highway 9 South
Freehold, New Jersey 07728
877-797-2978
www.Trinity-Solar.com

PVPowered

Selected Configurations for PVP 2000

Project Specifications

Module Manufacturer	Trina Solar
Module Model	TSM-235PA05
Mounting Type	Roof
Correction Factor	NEC (2008)
Temperaure Scale	Fahrenheit
Local Temperature Range	From -13 to 86
Inverter	PVP 2000

Module Specifications

Manufacturer	Trina Solar	Model	TSM-235PA05
STC Watts	235.0 watts	VOC Temp Coefficient	-0.1299 V/Deg C
PTC Watts	207.0 watts	Max Power Temp Coefficient	n/a
VOC	37.1 vdc	Coldest Day VOC	44.5 vdc
VMP	30.1 vdc	Warmest Day VMP	26.6 vdc
IMP	7.81 A		

Inverter Specifications: PVP 2000

Maximum DC Input Voltage	500 V	Continuous Power Output	2,000 W
Maximum STC DC Input Power	2,500 W	Weighted CEC Efficiency	92.0%
DC Voltage Operating Range	115 - 450 V	AC Nominal Voltage	240 V
DC ISC Maximum Current	26.0 A	AC Operating Range	211 - 264 V
DC IMP Nominal Current	18 A	AC Frequency	60 Hz
		AC Maximum Continuous Current	9 A

Selected Configurations

Parallel Strings	Series Modules	STC Watts	PTC Watts	Inverter AC Watts	STC VOC	Coldest Day VOC	STC VMP	Warmest Day VMP	STC IMP
2	5	2,350 W	2,070 W	1,904 W	186 vdc	223 vdc	151 vdc	133 vdc	15.62 A
1	10	2,350 W	2,070 W	1,904 W	371 vdc	446 vdc	301 vdc	266 vdc	7.81 A
1	9	2,115 W	1,863 W	1,713 W	334 vdc	401 vdc	271 vdc	239 vdc	7.81 A
1	8	1,880 W	1,656 W	1,523 W	297 vdc	357 vdc	241 vdc	213 vdc	7.81 A
1	7	1,645 W	1,449 W	1,333 W	260 vdc	312 vdc	211 vdc	186 vdc	7.81 A
1	6	1,410 W	1,242 W	1,142 W	223 vdc	268 vdc	181 vdc	159 vdc	7.81 A
1	5	1,175 W	1,035 W	952 W	186 vdc	223 vdc	151 vdc	133 vdc	7.81 A

PVPowered

Selected Configurations for PVP 3500

Project Specifications

Module Manufacturer	Trina Solar
Module Model	TSM-235PA05
Mounting Type	Roof
Correction Factor	NEC (2008)
Temperaure Scale	Fahrenheit
Local Temperature Range	From -13 to 86
Inverter	PVP 3500

Module Specifications

Manufacturer	Trina Solar	Model	TSM-235PA05
STC Watts	235.0 watts	VOC Temp Coefficient	-0.1299 V/Deg C
PTC Watts	207.0 watts	Max Power Temp Coefficient	n/a
VOC	37.1 vdc	Coldest Day VOC	44.5 vdc
VMP	30.1 vdc	Warmest Day VMP	26.6 vdc
IMP	7.81 A		

Inverter Specifications: PVP 3500

Maximum DC Input Voltage	500 V	Continuous Power Output	3,500 W
Maximum STC DC Input Power	4,375 W	Weighted CEC Efficiency	95.5%
DC Voltage Operating Range	200 - 450 V	AC Nominal Voltage	240 V
DC ISC Maximum Current	48.0 A	AC Operating Range	214 - 261 V
DC IMP Nominal Current	18 A	AC Frequency	60 Hz
		AC Maximum Continuous Current	15 A

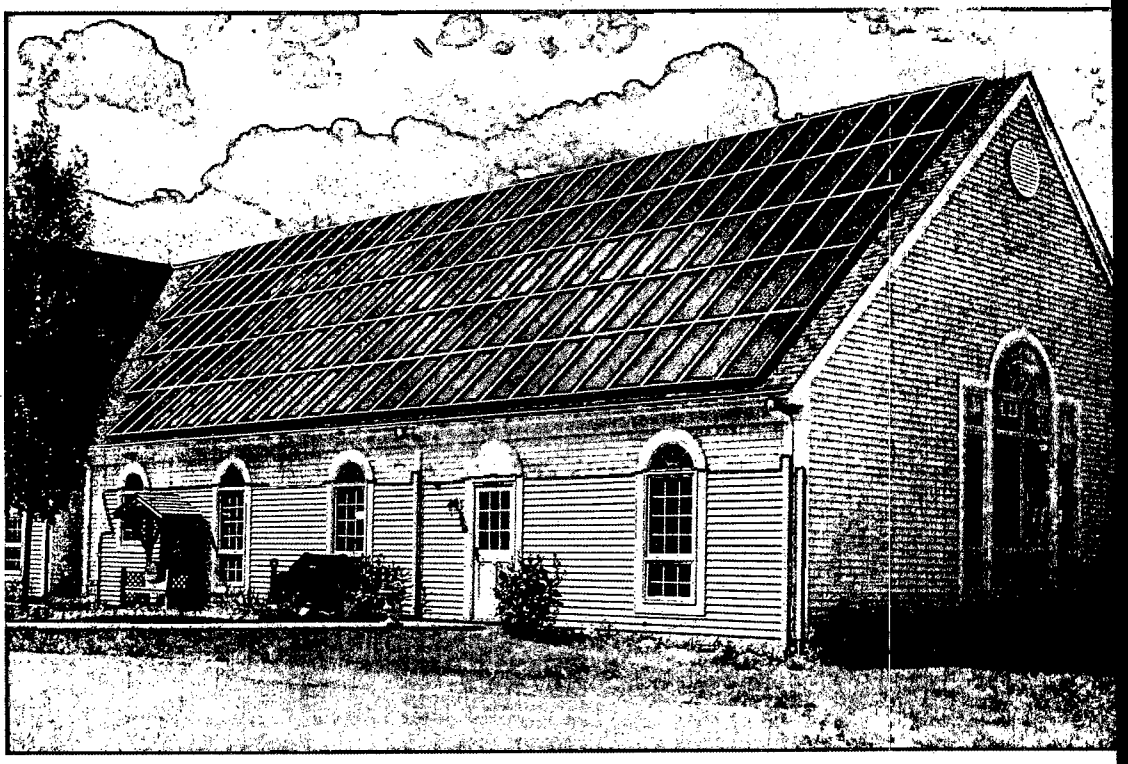
Selected Configurations

Parallel Strings	Series Modules	STC Watts	PTC Watts	Inverter AC Watts	STC VOC	Coldest Day VOC	STC VMP	Warmest Day VMP	STC IMP
2	9	4,230 W	3,726 W	3,558 W	334 vdc	401 vdc	271 vdc	239 vdc	15.62 A
2	8	3,760 W	3,312 W	3,162 W	297 vdc	357 vdc	241 vdc	213 vdc	15.62 A
1	11	2,585 W	2,277 W	2,174 W	409 vdc	490 vdc	332 vdc	292 vdc	7.81 A
1	10	2,350 W	2,070 W	1,976 W	371 vdc	446 vdc	301 vdc	266 vdc	7.81 A
1	9	2,115 W	1,863 W	1,779 W	334 vdc	401 vdc	271 vdc	239 vdc	7.81 A
1	8	1,880 W	1,656 W	1,581 W	297 vdc	357 vdc	241 vdc	213 vdc	7.81 A

SOLARMOUNT™

Code-Compliant Installation Manual 227.3

U.S. Des. Patent No. D496,248S, D496,249S. Other patents pending.



Unirac Code-Compliant Installation Manual

Table of Contents

UNIRAC®
A HILTI GROUP COMPANY

Pub 100511-1cc
May 2010

Unirac welcomes input concerning the accuracy and user-friendliness of this publication. Please write to **publications@unirac.com.**

i. Installer's Responsibilities

Please review this manual thoroughly before installing your SolarMount system.

This manual provides (1) supporting documentation for building permit applications relating to Unirac's SolarMount Universal PV Module Mounting system, and (2) planning and assembly instructions for SolarMount

SolarMount products, when installed in accordance with this bulletin, will be structurally adequate and will meet the structural requirements of the IBC 2006, IBC 2003, ASCE 7-02, ASCE 7-05 and California Building Code 2007 (collectively referred to as "the Code"). Unirac also provides a limited warranty on SolarMount products (page 26).

SolarMount is much more than a product.

It's a system of engineered components that can be assembled into a wide variety of PV mounting structures. With SolarMount you'll be able to solve virtually any PV module mounting challenge.

It's also a system of technical support: complete installation and code compliance documentation, an on-line SolarMount Estimator, person-to-person customer service, and design assistance to help you solve the toughest challenges.

This is why SolarMount is PV's most widely used mounting system.

The installer is solely responsible for:

- Complying with all applicable local or national building codes, including any that may supersede this manual;
- Ensuring that Unirac and other products are appropriate for the particular installation and the installation environment;
- Ensuring that the roof, its rafters, connections, and other structural support members can support the array under all code level loading conditions (this total building assembly is referred to as the building structure);
- Using only Unirac parts and installer-supplied parts as specified by Unirac (substitution of parts may void the warranty and invalidate the letters of certification in all Unirac publications);
- Ensuring that lag screws have adequate pullout strength and shear capacities as installed;
- Verifying the strength of any alternate mounting used in lieu of the lag screws;
- Maintaining the waterproof integrity of the roof, including selection of appropriate flashing;
- Ensuring safe installation of all electrical aspects of the PV array;
- Ensuring correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure and topographic factor should be confirmed with the local building official or a licensed professional engineer.

Part I. Procedure to Determine the Design Wind Load

[1.1.] Using the Simplified Method - ASCE 7-05

The procedure to determine Design Wind Load is specified by the American Society of Civil Engineers and referenced in the International Building Code 2006. For purposes of this document, the values, equations and procedures used in this document reference ASCE 7-05, Minimum Design Loads for Buildings and Other Structures. ***Please refer to ASCE 7-05 if you have any questions about the definitions or procedures presented in this manual.*** Unirac uses Method 1, the Simplified Method, for calculating the Design Wind Load for pressures on components and cladding in this document.

The method described in this document is valid for flush, no tilt, SolarMount Series applications on either roofs or walls. Flush is defined as panels parallel to the surface (or with no more than 3" difference between ends of assembly) with no more than 10" space between the roof surface, and the bottom of the PV panels.

This method is not approved for open structure calculations. ***Applications of these procedures is subject to the following ASCE 7-05 limitations:***

1. The building height must be less than 60 feet, h < 60. See note for determining h in the next section. For installations on structures greater than 60 feet, contact your local Unirac Distributor.

2. The building must be enclosed, not an open or partially enclosed structure, for example a carport.

3. The building is regular shaped with no unusual geometrical irregularity in spatial form, for example a geodesic dome.

4. The building is not in an extreme geographic location such as a narrow canyon or steep cliff.

5. The building has a flat or gable roof with a pitch less than 45 degrees or a hip roof with a pitch less than 27 degrees.

6. If your installation does not conform to these requirements please contact your local Unirac distributor or a local professional engineer.

If your installation is outside the United States or does not meet all of these limitations, consult a local professional engineer or your local building authority. Consult ASCE 7-05 for more clarification on the use of Method I. Lower design wind loads may be obtained by applying Method II from ASCE 7-05. Consult with a licensed engineer if you want to use Method II procedures.

The equation for determining the Design Wind Load for components and cladding is:

$$p_{net}\,(psf) = \lambda K_{zt} I\, p_{net30}$$

$p_{net}\,(psf)$ = *Design Wind Load*

λ = *adjustment factor for height and exposure category*

K_{zt} = *Topographic Factor at mean roof height, h (ft)*

I = *Importance Factor*

$p_{net30}\,(psf)$ = *net design wind pressure for Exposure B, at height = 30, I = 1*

You will also need to know the following information:

Basic Wind Speed = V (mph), the largest 3 second gust of wind in the last 50 years.

h (ft) = total roof height for flat roof buildings or mean roof height for pitched roof buildings

Roof Pitch (degrees)

This manual will help you determine:

Effective Wind Area (sf) = minimum total continuous area of modules being installed (Step 2)

Roof Zone = the area of the roof you are installing the pv system according to Step 3.

Roof Zone Dimension = a (ft) (Step 3)

Exposure Category (Step 6)

[1.2.] Procedure to Calculate Total Design Wind

The procedure for determining the Design Wind Load can be broken into steps that include looking up several values in different tables. Table 5 has been provided as a worksheet for the following 9 steps (page 8)

Step 1: Determine *Basic Wind Speed, V (mph)*

Determine the *Basic Wind Speed, V (mph)* by consulting your local building department or locating your installation on the maps in Figure 1, page 4.

Step 2: Determining *Effective Wind Area*

Determine the smallest area of continuous modules you will be installing. This is the smallest area tributary (contributing load) to a support or to a simple-span of rail. That area is the Effective Wind Area, the total area of the fewest number of modules on a run of rails. If the smallest area of continuous modules exceeds 100 sq ft, use 100 sq ft (See Table 2). If less, round down to values available in Table 2.

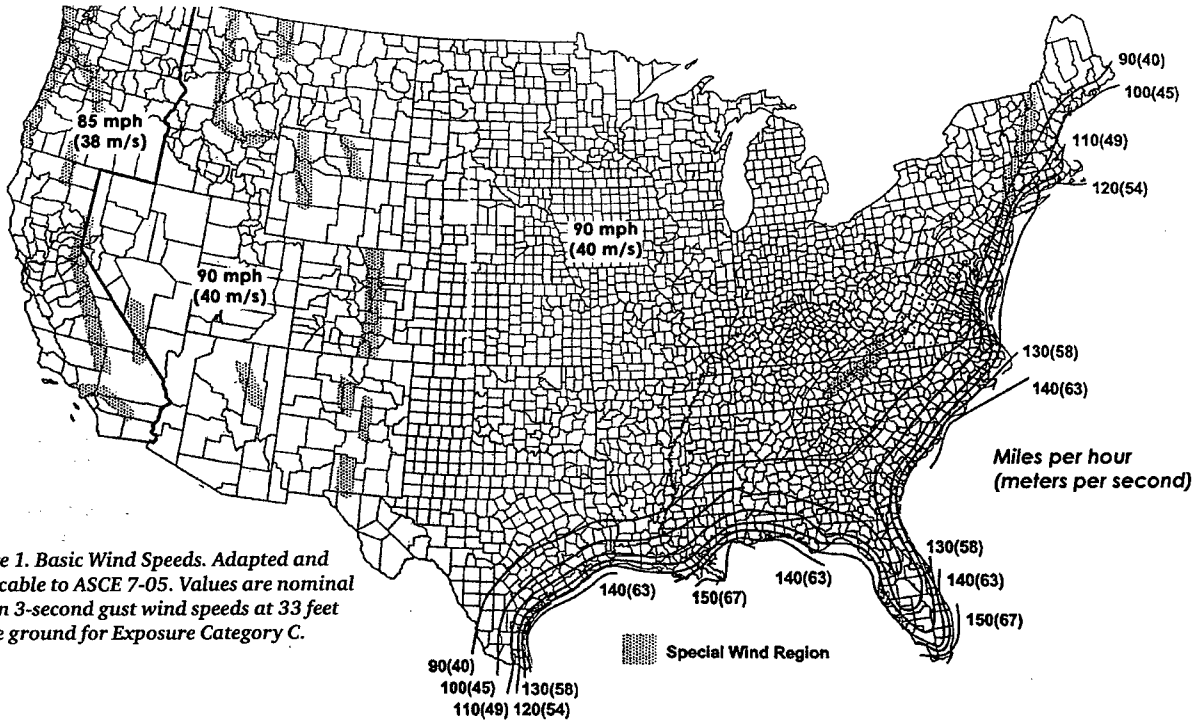


Figure 1. Basic Wind Speeds. Adapted and applicable to ASCE 7-05. Values are nominal design 3-second gust wind speeds at 33 feet above ground for Exposure Category C.

Step 3: Determine *Roof/Wall Zone*

The *Design Wind Load* will vary based on where the installation is located on a roof. Arrays may be located in more than one roof zone.

Using Table 1, determine the *Roof Zone Dimension Length, a (ft)*, according to the width and height of the building on which you are installing the pv system.

Table 1. Determine Roof/Wall Zone, dimension (**a**) according to building width and height

a = 10 percent of the least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of the least horizontal dimension or 3 ft of the building.

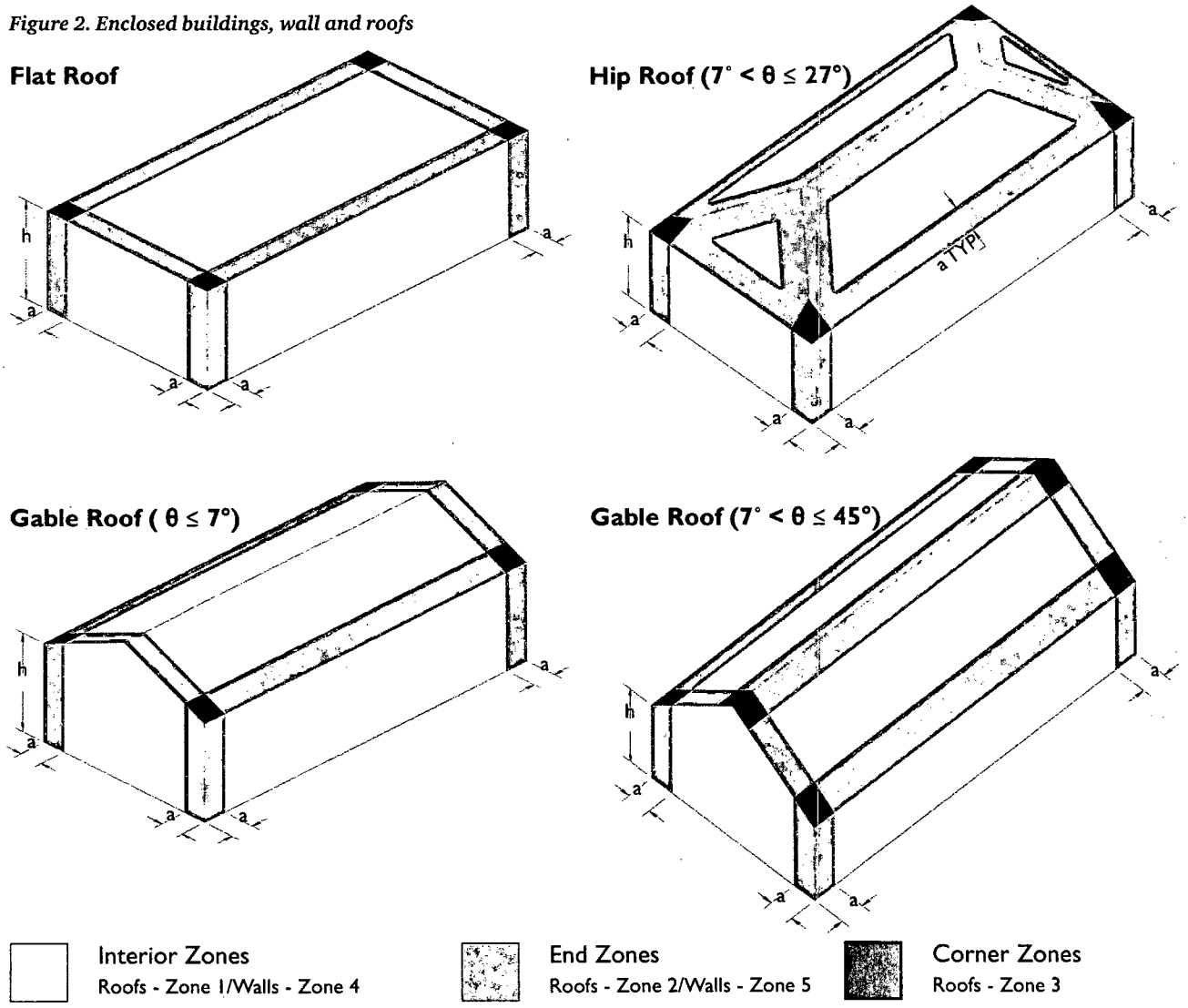
Roof Height (ft)	*Least Horizontal Dimension (ft)*																		
	10	***15***	***20***	***25***	***30***	***40***	***50***	***60***	***70***	***80***	***90***	***100***	***125***	***150***	***175***	***200***	***300***	***400***	***500***
10	3	3	3	3	3	4	4	4	4	4	4	4	5	6	7	8	12	16	20
15	3	3	3	3	3	4	5	6	6	6	6	6	6	6	7	8	12	16	20
20	3	3	3	3	3	4	5	6	7	8	8	8	8	8	8	8	12	16	20
25	3	3	3	3	3	4	5	6	7	8	9	10	10	10	10	10	12	16	20
30	3	3	3	3	3	4	5	6	7	8	9	10	12	12	12	12	12	16	20
35	3	3	3	3	3	4	5	6	7	8	9	10	12.5	14	14	14	14	16	20
40	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	16	16	16	16	20
45	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	18	18	18	20
50	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	20	20	20	20
60	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	20	24	24	24

Source: ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, Chapter 6, Figure 6-3, p. 41.

Step 3: Determine *Roof Zone (continued)*

Using *Roof Zone Dimension Length*, a, determine the roof zone locations according to your roof type, gable, hip or monoslope. Determine in which roof zone your pv system is located, Zone 1, 2, or 3 according to Figure 2.

Figure 2. Enclosed buildings, wall and roofs



Source: ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, Chapter 6, p. 41.

Step 4: Determine *Net Design Wind Pressure, p_{net30} (psf)*

Using the *Effective Wind Area* **(Step 2)**, *Roof Zone Location* **(Step 3)**, and *Basic Wind Speed* **(Step 1)**, look up the appropriate *Net Design Wind Pressure* in **Table 2, page 6**. Use the *Effective Wind Area* value in the table which is smaller than the value calculated in **Step 2**. If the installation is located on a roof overhang, use **Table 3, page 7**.

Both downforce and uplift pressures must be considered in overall design. Refer to **Section II, Step 1** for applying downforce and uplift pressures. Positive values are acting toward the surface. Negative values are acting away from the surface.

Table 2. p_{net30} (psf) Roof and Wall

			Basic Wind Speed,V (mph)															
			90		100		110		120		130		140		150		170	
	Zone	Effective Wind Area (sf)	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift	Downforce	Uplift
Roof 0 to 7 degrees	1	10	5.9	-14.6	7.3	-18.0	8.9	-21.8	10.5	-25.9	12.4	-30.4	14.3	-35.3	16.5	-40.5	21.1	-52.0
	1	20	5.6	-14.2	6.9	-17.5	8.3	-21.2	9.9	-25.2	11.6	-29.6	13.4	-34.4	15.4	-39.4	19.8	-50.7
	1	50	5.1	-13.7	6.3	-16.9	7.6	-20.5	9.0	-24.4	10.6	-28.6	12.3	-33.2	14.1	-38.1	18.1	-48.9
	1	100	4.7	-13.3	5.8	-16.5	7.0	-19.9	8.3	-23.7	9.8	-27.8	11.4	-32.3	13.0	-37.0	16.7	-47.6
	2	10	5.9	-24.4	7.3	-30.2	8.9	-36.5	10.5	-43.5	12.4	-51.0	14.3	-59.2	16.5	-67.9	21.1	-87.2
	2	20	5.6	-21.8	6.9	-27.0	8.3	-32.6	9.9	-38.8	11.6	-45.6	13.4	-52.9	15.4	-60.7	19.8	-78.0
	2	50	5.1	-18.4	6.3	-22.7	7.6	-27.5	9.0	-32.7	10.6	-38.4	12.3	-44.5	14.1	-51.1	18.1	-65.7
	2	100	4.7	-15.8	5.8	-19.5	7.0	-23.6	8.3	-28.1	9.8	-33.0	11.4	-38.2	13.0	-43.9	16.7	-56.4
	3	10	5.9	-36.8	7.3	-45.4	8.9	-55.0	10.5	-65.4	12.4	-76.8	14.3	-89.0	16.5	-102.2	21.1	-131.3
	3	20	5.6	-30.5	6.9	-37.6	8.3	-45.5	9.9	-54.2	11.6	-63.6	13.4	-73.8	15.4	-84.7	19.8	-108.7
	3	50	5.1	-22.1	6.3	-27.3	7.6	-33.1	9.0	-39.3	10.6	-46.2	12.3	-53.5	14.1	-61.5	18.1	-78.9
	3	100	4.7	-15.8	5.8	-19.5	7.0	-23.6	8.3	-28.1	9.8	-33.0	11.4	-38.2	13.0	-43.9	16.7	-56.4
Roof >7 to 27degrees	1	10	8.4	-13.3	10.4	-16.5	12.5	-19.9	14.9	-23.7	17.5	-27.8	20.3	-32.3	23.3	-37.0	30.0	-47.6
	1	20	7.7	-13.0	9.4	-16.0	11.4	-19.4	13.6	-23.0	16.0	-27.0	18.5	-31.4	21.3	-36.0	27.3	-46.3
	1	50	6.7	-12.5	8.2	-15.4	10.0	-18.6	11.9	-22.2	13.9	-26.0	16.1	-30.2	18.5	-34.6	23.8	-44.5
	1	100	5.9	-12.1	7.3	-14.9	8.9	-18.1	10.5	-21.5	12.4	-25.2	14.3	-29.3	16.5	-33.6	21.1	-43.2
	2	10	8.4	-23.2	10.4	-28.7	12.5	-34.7	14.9	-41.3	17.5	-48.4	20.3	-56.2	23.3	-64.5	30.0	-82.8
	2	20	7.7	-21.4	9.4	-26.4	11.4	-31.9	13.6	-38.0	16.0	-44.6	18.5	-51.7	21.3	-59.3	27.3	-76.2
	2	50	6.7	-18.9	8.2	-23.3	10.0	-28.2	11.9	-33.6	13.9	-39.4	16.1	-45.7	18.5	-52.5	23.8	-67.4
	2	100	5.9	-17.0	7.3	-21.0	8.9	-25.5	10.5	-30.3	12.4	-35.6	14.3	-41.2	16.5	-47.3	21.1	-60.8
	3	10	8.4	-34.3	10.4	-42.4	12.5	-51.3	14.9	-61.0	17.5	-71.6	20.3	-83.1	23.3	-95.4	30.0	-122.5
	3	20	7.7	-32.1	9.4	-39.6	11.4	-47.9	13.6	-57.1	16.0	-67.0	18.5	-77.7	21.3	-89.2	27.3	-114.5
	3	50	6.7	-29.1	8.2	-36.0	10.0	-43.5	11.9	-51.8	13.9	-60.8	16.1	-70.5	18.5	-81.0	23.8	-104.0
	3	100	5.9	-26.9	7.3	-33.2	8.9	-40.2	10.5	-47.9	12.4	-56.2	14.3	-65.1	16.5	-74.8	21.1	-96.0
Roof >27 to 45 degrees	1	10	13.3	-14.6	16.5	-18.0	19.9	-21.8	23.7	-25.9	27.8	-30.4	32.3	-35.3	37.0	-40.5	47.6	-52.0
	1	20	13.0	-13.8	16.0	-17.1	19.4	-20.7	23.0	-24.6	27.0	-28.9	31.4	-33.5	36.0	-38.4	46.3	-49.3
	1	50	12.5	-12.8	15.4	-15.9	18.6	-19.2	22.2	-22.8	26.0	-26.8	30.2	-31.1	34.6	-35.7	44.5	-45.8
	1	100	12.1	-12.1	14.9	-14.9	18.1	-18.1	21.5	-21.5	25.2	-25.2	29.3	-29.3	33.6	-33.6	43.2	-43.2
	2	10	13.3	-17.0	16.5	-21.0	19.9	-25.5	23.7	-30.3	27.8	-35.6	32.3	-41.2	37.0	-47.3	47.6	-60.8
	2	20	13.0	-16.3	16.0	-20.1	19.4	-24.3	23.0	-29.0	27.0	-34.0	31.4	-39.4	36.0	-45.3	46.3	-58.1
	2	50	12.5	-15.3	15.4	-18.9	18.6	-22.9	22.2	-27.2	26.0	-32.0	30.2	-37.1	34.6	-42.5	44.5	-54.6
	2	100	12.1	-14.6	14.9	-18.0	18.1	-21.8	21.5	-25.9	25.2	-30.4	29.3	-35.3	33.6	40.5	43.2	-52.0
	3	10	13.3	-17.0	16.5	-21.0	19.9	-25.5	23.7	-30.3	27.8	-35.6	32.3	-41.2	37.0	-47.3	47.6	-60.8
	3	20	13.0	-16.3	16.0	-20.1	19.4	-24.3	23.0	-29.0	27.0	-34.0	31.4	-39.4	36.0	-45.3	46.3	-58.1
	3	50	12.5	-15.3	15.4	-18.9	18.6	-22.9	22.2	-27.2	26.0	-32.0	30.2	-37.1	34.6	-42.5	44.5	-54.6
	3	100	12.1	-14.6	14.9	-18.0	18.1	-21.8	21.5	-25.9	25.2	-30.4	29.3	-35.3	33.6	-40.5	43.2	-52.0
Wall	4	10	14.6	-15.8	18.0	-19.5	21.8	-23.6	25.9	-28.1	30.4	-33.0	35.3	-38.2	40.5	-43.9	52.0	-56.4
	4	20	13.9	-15.1	17.2	-18.7	20.8	-22.6	24.7	-26.9	29.0	-31.6	33.7	-36.7	38.7	-42.1	49.6	-54.1
	4	50	13.0	-14.3	16.1	-17.6	19.5	-21.3	23.2	-25.4	27.2	-29.8	31.6	-34.6	36.2	-39.7	46.6	-51.0
	4	100	12.4	-13.6	15.3	-16.8	18.5	-20.4	22.0	-24.2	25.9	-28.4	30.0	-33.0	34.4	-37.8	44.2	-48.6
	4	500	10.9	-12.1	13.4	-14.9	16.2	-18.1	19.3	-21.5	22.7	-25.2	26.3	-29.3	30.2	-33.6	38.8	-43.2
	5	10	14.6	-19.5	18.0	-24.1	21.8	-29.1	25.9	-34.7	30.4	-40.7	35.3	-47.2	40.5	-54.2	52.0	-69.6
	5	20	13.9	-18.2	17.2	-22.5	20.8	-27.2	24.7	-32.4	29.0	-38.0	33.7	-44.0	38.7	-50.5	49.6	-64.9
	5	50	13.0	-16.5	16.1	-20.3	19.5	-24.6	23.2	-29.3	27.2	-34.3	31.6	-39.8	36.2	-45.7	46.6	-58.7
	5	100	12.4	-15.1	15.3	-18.7	18.5	-22.6	22.0	-26.9	25.9	-31.6	30.0	-36.7	34.4	-42.1	44.2	-54.1
	5	500	10.9	-12.1	13.4	-14.9	16.2	-18.1	19.3	-21.5	22.7	-25.2	26.3	-29.3	30.2	-33.6	38.8	-43.2

Source: ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, Chapter 6, Figure 6-3, p. 42-43.

Table 3. p_{net30} (psf) Roof Overhang

	Zone	Effective Wind Area (sf)	Basic Wind Speed, V (mph)							
			90	100	110	120	130	140	150	170
Roof 0 to 7 degrees	2	10	-21.0	-25.9	-31.4	-37.3	-43.8	-50.8	-58.3	-74.9
	2	20	-20.6	-25.5	-30.8	-36.7	-43.0	-49.9	-57.3	-73.6
	2	50	-20.1	-24.9	-30.1	-35.8	-42.0	-48.7	-55.9	-71.8
	2	100	-19.8	-24.4	-29.5	-35.1	-41.2	-47.8	-54.9	-70.5
	3	10	-34.6	-42.7	-51.6	-61.5	-72.1	-83.7	-96.0	-123.4
	3	20	-27.1	-33.5	-40.5	-48.3	-56.6	-65.7	-75.4	-96.8
	3	50	-17.3	-21.4	-25.9	-30.8	-36.1	-41.9	-48.1	-61.8
	3	100	-10.0	-12.2	-14.8	-17.6	-20.6	-23.9	-27.4	-35.2
Roof >7 to 27degrees	2	10	-27.2	-33.5	-40.6	-48.3	-56.7	-65.7	-75.5	-96.9
	2	20	-27.2	-33.5	-40.6	-48.3	-56.7	-65.7	-75.5	-96.9
	2	50	-27.2	-33.5	-40.6	-48.3	-56.7	-65.7	-75.5	-96.9
	2	100	-27.2	-33.5	-40.6	-48.3	-56.7	-65.7	-75.5	-96.9
	3	10	-45.7	-56.4	-68.3	-81.2	-95.3	-110.6	-126.9	-163.0
	3	20	-41.2	-50.9	-61.6	-73.3	-86.0	-99.8	-114.5	-147.1
	3	50	-35.3	-43.6	-52.8	-62.8	-73.7	-85.5	-98.1	-126.1
	3	100	-30.9	-38.1	-46.1	-54.9	-64.4	-74.7	-85.8	-110.1
Roof >27 to 45degrees	2	10	-24.7	-30.5	-36.9	-43.9	-51.5	-59.8	-68.6	-88.1
	2	20	-24.0	-29.6	-35.8	-42.6	-50.0	-58.0	-66.5	-85.5
	2	50	-23.0	-28.4	-34.3	-40.8	-47.9	-55.6	-63.8	-82.0
	2	100	-22.2	-27.4	-33.2	-39.5	-46.4	-53.8	-61.7	-79.3
	3	10	-24.7	-30.5	-36.9	-43.9	-51.5	-59.8	-68.6	-88.1
	3	20	-24.0	-29.6	-35.8	-42.6	-50.0	-58.0	-66.5	-85.5
	3	50	-23.0	-28.4	-34.3	-40.8	-47.9	-55.6	-63.8	-82.0
	3	100	-22.2	-27.4	-33.2	-39.5	-46.4	-53.8	-61.7	-79.3

Source: ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, Chapter 6, p. 44.

Step 5: Determine the Topographic Factor, K_{zt}

For the purposes of this code compliance document, the *Topographic Factor*, K_{zt}, is taken as equal to one (1), meaning, the installation is surrounded by level ground (less than 10% slope). If the installation is not surrounded by level ground, please consult ASCE 7-05, Section 6.5.7 and the local building authority to determine the *Topographic Factor*.

Step 6: Determine *Exposure Category (B, C, D)*

Determine the *Exposure Category* by using the following definitions for Exposure Categories.

The ASCE/SEI 7-05 defines wind exposure categories as follows:

EXPOSURE B: is urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single family dwellings.

EXPOSURE C: has open terrain with scattered obstructions having heights generally less than 30 feet. This category includes flat open country, grasslands, and all water surfaces in hurricane prone regions.

EXPOSURE D: has flat, unobstructed areas and water surfaces outside hurricane prone regions. This category includes smooth mud flats, salt flats, and unbroken ice.

Also see ASCE 7-05 pages 287-291 for further explanation and explanatory photographs, and confirm your selection with the local building authority.

Step 7: Determine adjustment factor for height and exposure category, λ

Using the *Exposure Category* (**Step 6**) and the *roof height, h (ft)*, look up the *adjustment factor for height and exposure* in **Table 4**.

Step 8: Determine the Importance Factor, I

Determine if the installation is in a hurricane prone region. Look up the *Importance Factor, I*, Table 6, page 9, using the occupancy category description and the hurricane prone region status.

Step 9: Calculate the Design Wind Load, p_{net} (psf)

Multiply the *Net Design Wind Pressure, p_{net30}* (psf) (**Step 4**) by the *adjustment factor for height and exposure, λ* (**Step 7**), the *Topographic Factor, K_{zt}* (**Step 5**), and the *Importance Factor, I* (**Step 8**) using the following equation, or Table 5 Worksheet.

$$p_{net}\ (psf) = \lambda K_{zt} I\, p_{net30}$$

p_{net} *(psf) = Design Wind Load (10 psf minimum)*

λ *= adjustment factor for height and exposure category* (**Step 7**)

K_{zt} *= Topographic Factor at mean roof height, h (ft)* (**Step 5**)

I = Importance Factor (**Step 8**)

p_{net30} *(psf) = net design wind pressure for Exposure B, at height = 30, I = 1* (**Step 4**)

Use **Table 5** below to calculate Design Wind Load.

The Design Wind Load will be used in **Part II** to select the appropriate SolarMount Series rail, rail span and foot spacing.

In **Part II**, use both the positive (downforce) and the negative (uplift) results from this calculation.

Table 4. Adjustment Factor (λ) for Roof Height & Exposure Category

Mean roof height (ft)	Exposure B	Exposure C	Exposure D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

Source: ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, Chapter 6, Figure 6-3, p. 44.

Table 5. Worksheet for Components and Cladding Wind Load Calculation: IBC 2006, ASCE 7-05

Variable Description	Symbol	Value	Unit	Step	Reference
Building Height	h		ft		
Building, Least Horizontal Dimension			ft		
Roof Pitch			degrees		
Exposure Category				6	
Basic Wind Speed	V		mph	1	Figure 1
Effective Wind Area			sf		
				2	
Roof Zone Setback Length	a		ft	3	Table 1
Roof Zone Location				3	Figure 2
Net Design Wind Pressure	p_{net30}		psf	4	Table 2, 3
Topographic Factor	K_{zt}	x		5	
Adjustment factor for height and exposure category	λ	x		7	Table 4
Importance Factor	I	x		8	Table 5
Total Design Wind Load	p_{net}		psf	9	

Table 6. Occupancy Category Importance Factor

Category	*Category Desicription*	*Building Type Examples*	*Non-Hurricane Prone Regions and Hurricane Prone Regions with Basic Wind Speed, V = 85-100 mph, and Alaska*	*Hurricane Prone Regions with Basic Wind Speed, V > 100mph*
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including, but limited to:	• Agricultural facilities • Certain Temporary facilities • Minor Storage facilities	0.87	0.77
II	All buildings and other structures except those listed in Occupancy Categories I, III, and IV.		1	1
III	Buildings and other structures that represent a substantial hazard to human life in the event of a failure, including, but not limited to:	• Buildings where more than 300 people congregate • Schools with a capacity more than 250 • Day Cares with a capacity more than 150 • Buildings for colleges with a capacity more than 500 • Health Care facilities with a capacity more than 50 or more resident patients • Jails and Detention Facilities • Power Generating Stations • Water and Sewage Treatment Facilities • Telecommunication Centers • Buildings that manufacture or house hazardous materials	1.15	1.15
IV	Buildings and other structures designated as essential facilities, including, but not limited to:	• Hospitals and other health care facilities having surgery or emergency treatment • Fire, rescue, ambulance and police stations • Designated earthquake, hurricane, or other emergency shelters • Designated emergency preparedness communication, and operation centers • Power generating stations and other public utility facilities required in an emergency • Ancillary structures required for operation of Occupancy Category IV structures • Aviation control towers, air traffic control centers, and emergency aircraft hangars • Water storage facilities and pump structures required to maintain water pressure for fire suppression • Buildings and other structures having critical national defense functions	1.15	1.15

Source: IBC 2006, Table 1604.5, Occupancy Category of Buildings and other structures, p. 281; ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, Table 6-1, p. 77

Part II. Procedure to Select Rail Span and Rail Type

[2.1.] Using Standard Beam Calculations, Structural Engineering Methodology

The procedure to determine the Unirac SolarMount series rail type and rail span uses standard beam calculations and structural engineering methodology. The beam calculations are based on a simply supported beam conservatively, ignoring the reductions allowed for supports of continuous beams over multiple supports. Please refer to **Part I** for more information on beam calculations, equations and assumptions. If beams are installed perpendicular to the eaves on a roof steeper than a 4/12 pitch in an area with a ground snow load greater than 30psf, then additional analysis is required for side loading on the roof attachment and beam.

In using this document, obtaining correct results is dependent upon the following:

1. Obtain the *Snow Load* for your area from your local building official.

2. Obtain the *Design Wind Load,* p_{net}. See **Part I** (Procedure to Determine the Design Wind Load) for more information on calculating the *Design Wind Load.*

3. ***Please Note:*** The terms rail span and footing spacing are interchangeable in this document. See **Figure 3** for illustrations.

4. To use **Table 8** and **Table 9** the *Dead Load* for your specific installation must be less than 5 psf, including modules and Unirac racking systems. If the Dead Load is greater than 5 psf, see your Unirac distributor, a local structural engineer or contact Unirac.

The following procedure will guide you in selecting a Unirac rail for a flush mount installation. It will also help determine the design loading imposed by the Unirac PV Mounting Assembly that the building structure must be capable of supporting.

Step 1: Determine the *Total Design Load*

The *Total Design Load, P (psf)* is determined using ASCE 7-05 2.4.1 (ASD Method equations 3,5,6 and 7) by adding the *Snow Load*[1], S (psf), *Design Wind Load,* p_{net} *(psf)* from **Part I, Step 9** and the *Dead Load (psf)*. Both Uplift and Downforce Wind Loads calculated in **Step 9 of Part 1** must be investigated. Use **Table 7** to calculate the Total Design Load for the load cases. Use the maximum absolute value of the three downforce cases and the uplift case for sizing the rail. Use the uplift case only for sizing lag bolts pull out capacities **(Part II, Step 6)**. Use the following equations or **Table 7**.

$P\ (psf) = 1.0D + 1.0S^1$ (downforce case 1)

$P\ (psf) = 1.0D + 1.0p_{net}$ (downforce case 2)

$P\ (psf) = 1.0D + 0.75S^1 + 0.75p_{net}$ (downforce case 3)

$P\ (psf) = 0.6D + 1.0p_{net}$ (uplift)

D = *Dead Load (psf)*

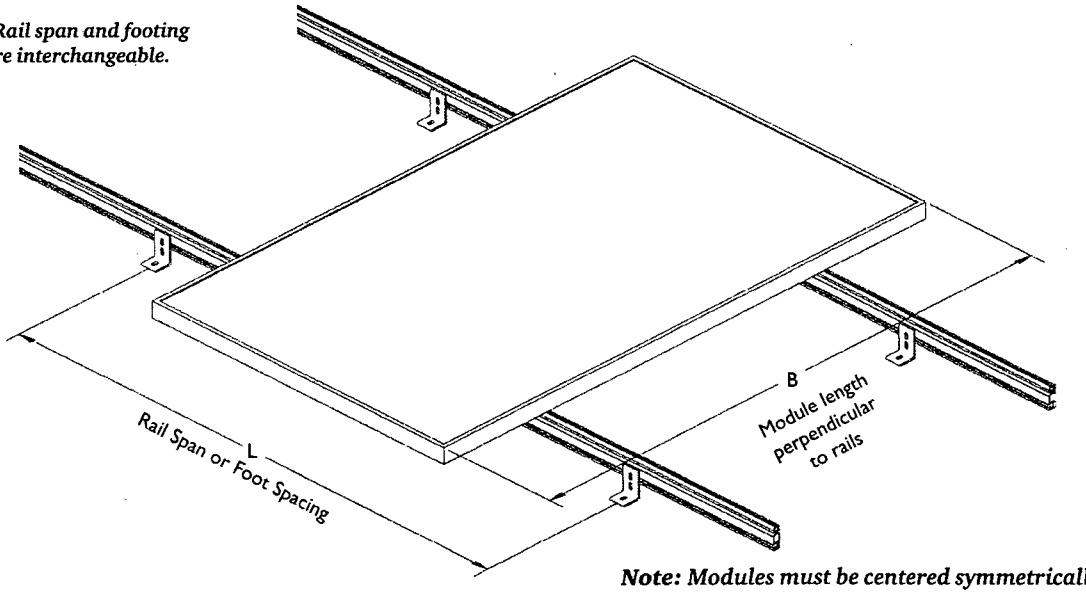
S = *Snow Load (psf)*

p_{net} = *Design Wind Load (psf) (Positive for downforce, negative for uplift)*

The maximum Dead Load, D (psf), is 5 psf based on market research and internal data.

[1] *Snow Load Reduction - The snow load can be reduced according to Chapter 7 of ASCE 7-05. The reduction is a function of the roof slope, Exposure Factor, Importance Factor and Thermal Factor. Please refer to Chapter 7 of ASCE 7-05 for more information.*

Figure 3. Rail span and footing spacing are interchangeable.



Note: Modules must be centered symmetrically on the rails (+/- 2*), as shown in Figure 3.

Table 7. ASCE 7 ASD Load Combinations

Description	*Variable*	*Downforce Case 1*	*Downforce Case 2*	*Downforce Case 3*	*Uplift*	*units*
Dead Load	D	1.0 x	1.0 x	1.0 x	0.6 x	psf
Snow Load	S	1.0 x + _____		0.75 x + _____		psf
Design Wind Load	Pnet		1.0 x + _____	0.75 x + _____	1.0 x -	psf
Total Design Load	P					psf

Note: Table to be filled out or attached for evaluation.

Step 2: Determine the *Distributed Load on the rail, w (plf)*

Determine the *Distributed Load, w (plf)*, by multiplying the module length, B (ft), by the *Total Design Load, P (psf)* and dividing by two. Use the maximum absolute value of the three downforce cases and the Uplift Case. We assume each module is supported by two rails.

$$w = PB/2$$

w = Distributed Load (pounds per linear foot, plf)

B = Module Length Perpendicular to Rails (ft)

P = Total Design Pressure (pounds per square foot, psf)

Step 3: Determine *Rail Span/ L-Foot Spacing*

Using the *distributed load, w*, from Part II, **Step 2**, look up the *allowable spans, L*, for each Unirac rail type, SolarMount (SM) and SolarMount Heavy Duty (HD).

The L-Foot SolarMount Series Rail Span Table uses a single L-foot connection to the roof, wall or stand-off. Please refer to the **Part III** for more installation information.

Table 8. L-Foot SolarMount Series Rail Span

SM - SolarMount **HD - SolarMount Heavy Duty**

Span (ft)	*Distributed Load (pounds/linear foot)*															
	20	25	30	40	50	60	80	100	120	140	160	180	200	220	240	260
2	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM
2.5	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD
3	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD	HD	HD
3.5	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD	HD		
4	SM	SM	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD	HD			
4.5	SM	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD					
5	SM	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD					
5.5	SM	SM	SM	SM	SM	SM	SM	HD	HD	HD						
6	SM	SM	SM	SM	SM	SM	SM	HD	HD							
6.5	SM	SM	SM	SM	SM	SM	SM	HD	HD							
7	SM	SM	SM	SM	SM	SM	HD	HD								
7.5	SM	SM	SM	SM	SM	SM	HD	HD								
8	SM	SM	SM	SM	SM	SM	HD	HD								
8.5	SM	SM	SM	SM	SM	HD	HD									
9	SM	SM	SM	SM	HD	HD	HD									
9.5	SM	SM	SM	SM	HD	HD	HD									
10	SM	SM	SM	HD	HD	HD	HD									
10.5	SM	SM	SM	HD	HD	HD										
11	SM	SM	HD	HD	HD	HD										
11.5	SM	HD	HD	HD	HD	HD										
12	SM	HD	HD	HD	HD	HD										

Step 4: Select Rail Type

Selecting a span and rail type affects the price of your installation. Longer spans produce fewer wall or roof penetrations. However, longer spans create higher point load forces on the building structure. A point load force is the amount of force transferred to the building structure at each connection.

It is the installer's responsibility to verify that the building structure is strong enough to support the point load forces.

Step 5: Determine the Downforce *Point Load, R (lbs)*, at each connection based on rail span

When designing the Unirac Flush Mount Installation, you must consider the downforce Point Load, R (lbs) on the roof structure.

The *Downforce, Point Load, R (lbs)*, is determined by multiplying the *Total Design Load, P (psf)* **(Step 1)** by the *Rail Span, L (ft)* **(Step 3)** and the *Module Length Perpendicular to the Rails, B (ft)* divided by two.

$$R\ (lbs) = PLB/2$$

R = Point Load (lbs)

P = Total Design Load (psf)

L = Rail Span (ft)

B = Module Length Perpendicular to Rails (ft)

It is the installer's responsibility to verify that the building structure is strong enough to support the maximum point loads calculated according to **Step 5**.

Table 10. Downforce Point Load Calculation

Total Design Load (downforce) (max of case 1, 2 or 3):	P			psf	Step 1
Module length perpendicular to rails:	B	x		ft	
Rail Span:	L	x		ft	Step 4
			/2		
Downforce Point Load:	R			lbs	

Step 6: Determine the Uplift Point Load, R (lbs), at each connection based on rail span

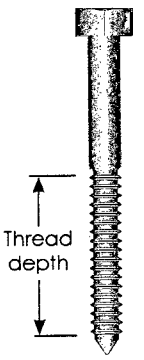
You must also consider the Uplift Point Load, R (lbs), to determine the required lag bolt attachment to the roof (building) structure.

Table 11. Uplift Point Load Calculation

Total Design Load (uplift):	P			psf	Step 1
Module length perpendicular to rails:	B	x		ft	
Rail Span:	L	x	_____	ft	Step 4
			/2		
Uplift Point Load:	R			lbs	

Table 12. Lag pull-out (withdrawal) capacities (lbs) in typical roof lumber (ASD)

	Specific gravity	Lag screw specifications: 5/16" shaft,* per inch thread depth
Douglas Fir, Larch	**0.50**	**266**
Douglas Fir, South	**0.46**	**235**
Engelmann Spruce, Lodgepole Pine (MSR 1650 f & higher)	**0.46**	**235**
Hem, Fir, Redwood (close grain)	**0.43**	**212**
Hem, Fir (North)	**0.46**	**235**
Southern Pine	**0.55**	**307**
Spruce, Pine, Fir	**0.42**	**205**
Spruce, Pine, Fir (E of 2 million psi and higher grades of MSR and MEL)	**0.50**	**266**



Sources: American Wood Council, NDS 2005, Table 11.2A, 11.3.2A.

Notes: (1) Thread must be embedded in the side grain of a rafter or other structural member integral with the building structure.
(2) Lag bolts must be located in the middle third of the structural member.
(3) These values are not valid for wet service.
(4) This table does not include shear capacities. If necessary, contact a local engineer to specifiy lag bolt size with regard to shear forces.
(5) Install lag bolts with head and washer flush to surface (no gap). Do not over-torque.
(6) Withdrawal design values for lag screw connections shall be multiplied by applicable adjustment factors if necessary. See Table 10.3.1 in the American Wood Council NDS for Wood Construction.

**Use flat washers with lag screws.*

Use **Table 12** to select a lag bolt size and embedment depth to satisfy your Uplift Point Load Force, R (lbs), requirements. Divide the uplift pointload (from **Table 11**) by the withdrawal capacity in the 2nd column of **Table 12**. This results in inches of 5/16 lagbolt embedded thread depth needed to counteract the uplift force. If other than lag bolt is used (as with a concrete or steel), consult fastener mfr documentation.

It is the installer's responsibility to verify that the substructure and attachment method is strong enough to support the maximum point loads calculated according to Step 5 and Step 6.

Part III. Installing SolarMount

The Unirac Code-Compliant Installation Instructions support applications for building permits for photovoltaic arrays using Unirac PV module mounting systems.

This manual, SolarMount Planning and Assembly, governs installations using the SolarMount and SolarMount HD (Heavy Duty) systems.

[3.1.] SolarMount rail components

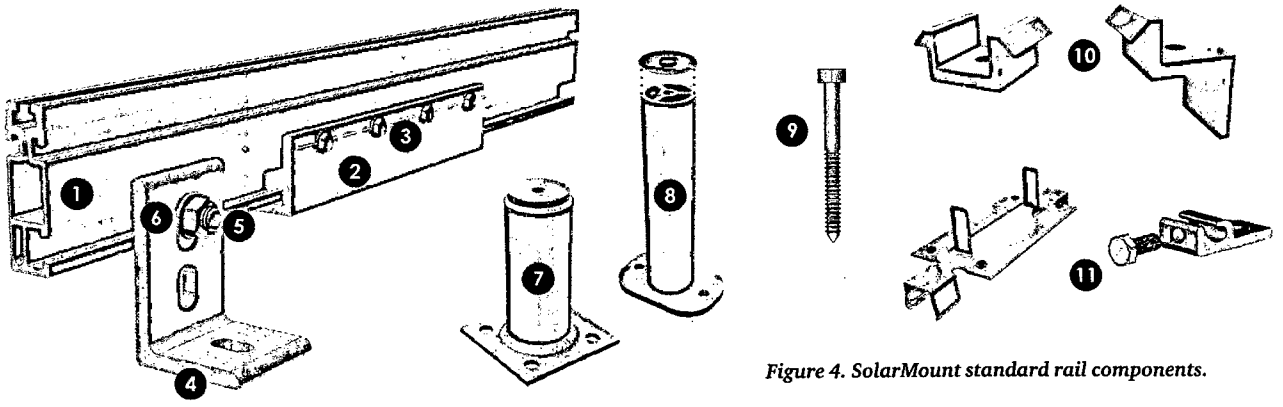


Figure 4. SolarMount standard rail components.

1. **Rail** – Supports PV modules. Use two per row of modules. Aluminum extrusion, anodized.

2. **Rail splice** – Joins and aligns rail sections into single length of rail. It can form either a rigid or thermal expansion joint, 8 inches long, predrilled. Aluminum extrusion, anodized.

3. **Self-drilling screw** – (No. 10 x ¾") – Use 4 per rigid splice or 2 per expansion joint. Galvanized steel.

4. **L-foot** – Use to secure rails either through roofing material to building structure or standoffs. Refer to loading tables for spacing. Note: Please contact Unirac for use and specification of double L-foot.

5. **L-foot bolt** (3/8" x ¾") – Use one per L-foot to secure rail to L-foot. Stainless steel.

6. **Flange nut** (3/8") – Use one per L-foot to secure rail to L-foot. Stainless steel.

7. **Flattop standoff** (optional) (3/8") – Use standoffs to increase the height of the array above the surface of the roof or to allow for the use of flashings. Use one per L-foot. One piece: Service Condition 4 (very severe) zinc-plated-welded steel. Includes 3/8" x ¼" bolt with lock washer for attaching L-foot. Flashings: Use one per standoff. Unirac offers appropriate flashings for both standoff types.
Note: There is also a flange type standoff that does not require an L-foot.

8. **Aluminum two-piece standoff** (optional) (4" and 7") – Use one per L-foot. Two-piece: Aluminum extrusion. Includes 3/8" x 3/4" serrated flange bolt with EPDM washer for attaching L-foot, and two 5/16" lag bolts.

9. **Lag screw for L-foot** (5/16") – Attaches standoff to rafter.

10. **Top Mounting Clamps**

11. **Top Mounting Grounding Clips and Lugs**

Installer supplied materials:

- **Lag screw for L-foot** – Attaches L-foot or standoff to rafter. Determine the length and diameter based on pull-out values. If lag screw head is exposed to elements, use stainless steel. Under flashings, zinc plated hardware is adequate.

- **Waterproof roofing sealant** – Use a sealant appropriate to your roofing material. Consult with the company currently providing warranty of roofing.

[3.2.] Installing SolarMount with top mounting clamps

This section covers SolarMount rack assembly where the installer has elected to use top mounting clamps to secure modules to the rails. It details the procedure for flush mounting SolarMount systems to a pitched roof.

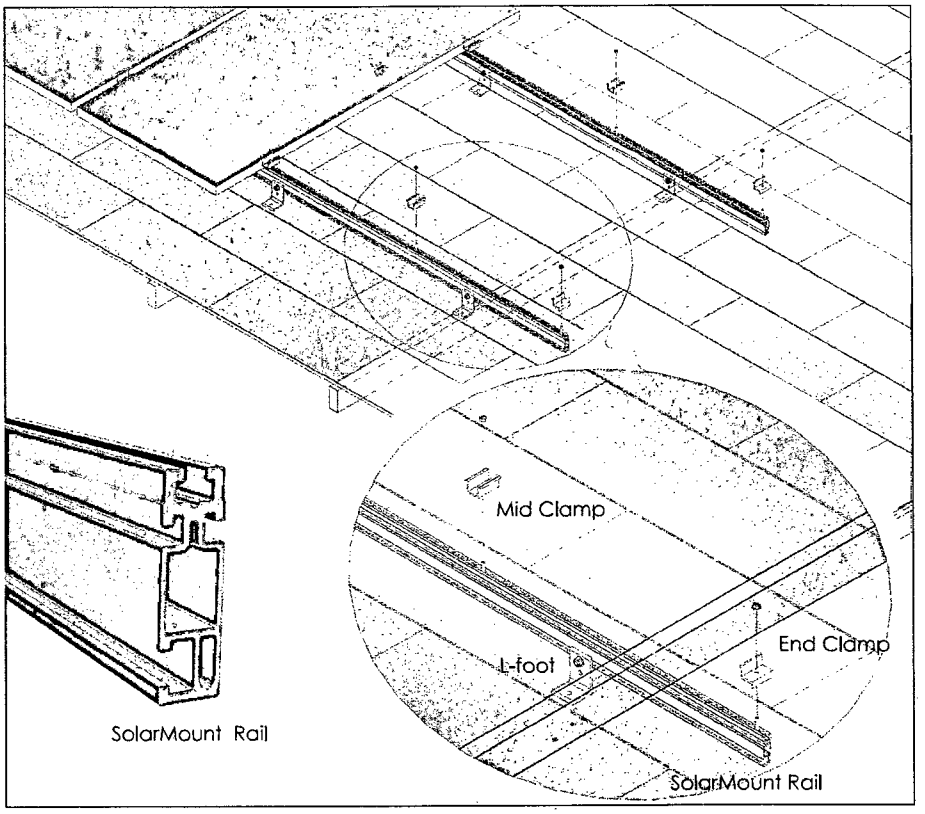


Figure 5. Exploded view of a flushmount installation mounted with L-feet.

Table 14. Clamp kit part quantities

Modules	End clamps	Mid clamps	¼" module clamp bolts	¼"x ⅝" safety bolts	¼" flange nuts
2	4	2	6	2	8
3	4	4	8	2	10
4	4	6	10	2	12
5	4	8	12	2	14
6	4	10	14	2	16
7	4	12	16	2	18
8	4	14	18	2	20

Table 15. Wrenches and torque

	Wrench size	Recommended torque (ft-lbs)
¼" hardware	7/16"	10 ⚠
⅜" hardware	9/16"	

Torques are not designated for use with wood connectors

⚠ ***All top down clamps must be installed with anti-seize to prevent galling and provide uniformity in clamp load. UniRac Inc recommends Silver Grade LocTite Anti-Seize Item numbers: 38181, 80209,76732,76759,76764, 80206, and 76775, or equivalent. 1/4" - 20 hardware used in conjunction with top down clamps must be installed to 10 ft-lbs of torque. When using UGC-1, UGC-2, WEEB 9.5 and WEEB 6.7, 1/4" - 20 hardware must be installed to 10 ft-lbs of torque. Additionally, when used with a top down clamp, the module frame cross section must be boxed shaped as opposed to a single, l-shaped member. Please refer to installation supplement 910: Galling and Its Prevention for more information on galling and anti-seize and installation manual 225: Top Mounting Unirac Grounding Clips and WEEBLugs for more information on Grounding Clips."***

[3.2.1] Planning your SolarMount installations

The installation can be laid out with rails parallel to the rafters or perpendicular to the rafters. Note that SolarMount rails make excellent straight edges for doing layouts.

Center the installation area over the structural members as much as possible.

Leave enough room to safely move around the array during installation. Some building codes require minimum clearances around such installations, and the user should be directed to also check 'The Code'.

The width of the installation area equals the length of one module.

The length of the installation area is equal to:

- the total width of the modules,
- plus 1 inch for each space between modules (for mid-clamp),
- plus 3 inches (1½ inches for each pair of end clamps).

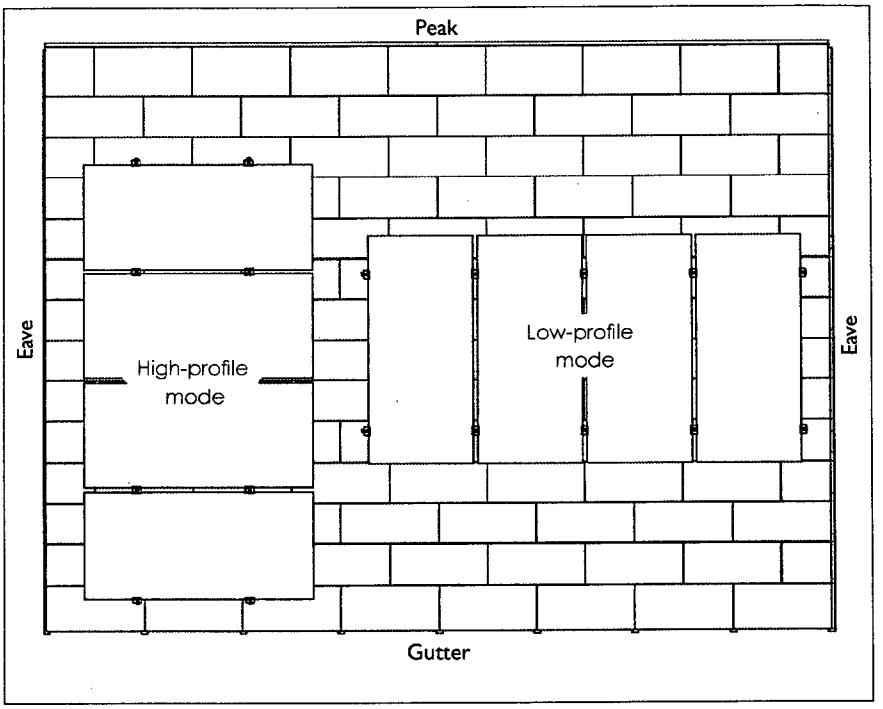


Figure 6. Rails may be placed parallel or perpendicular to rafters.

[3.2.2] Laying out L-feet

L-feet (**Fig. 7**) can be used for attachment through existing roofing material, such as asphalt shingles, sheathing or sheet metal to the building structure.

Use **Figure 8 or 9** below to locate and mark the position of the L-feet lag screw holes within the installation area.

If multiple rows are to be installed adjacent to one another, it is not likely that each row will be centered above the rafters. Adjust as needed, following the guidelines in **Figure 9** as closely as possible.

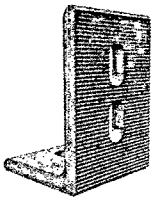


Figure 7

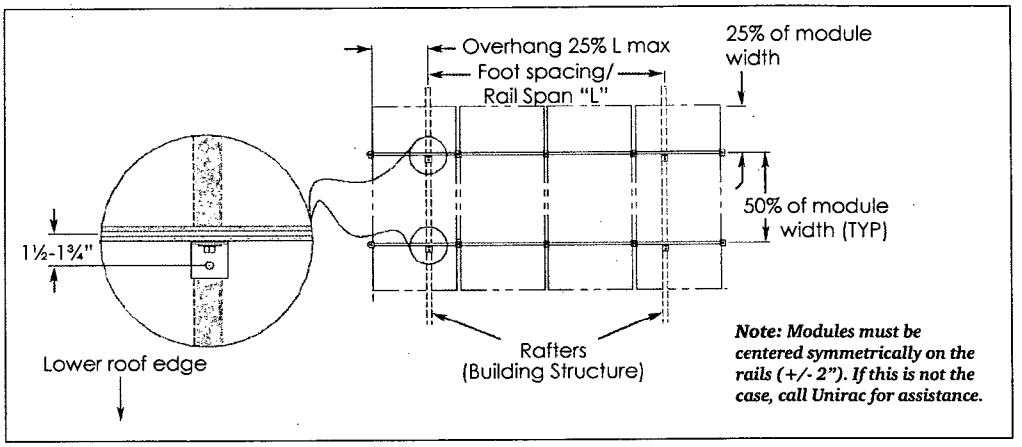


Figure 8. Layout with rails perpendicular to rafters.

Installing L-feet:

Drill pilot holes through the roof into the center of the rafter at each L-foot lag screw hole location.

Squirt sealant into the hole, and on the shafts of the lag screws. Seal the underside of the L-feet with a suitable sealant. Consult with the company providing the roofing warranty.

Securely fasten the L-feet to the roof with the lag screws. Ensure that the L-feet face as shown in **Figure 8 and 9**. For greater ventilation, the preferred method is to place the single-slotted square side of the L-foot against the roof with the double-slotted side perpendicular to the roof. If the installer chooses to mount the L-foot with the long leg against the roof, the bolt slot closest to the bend must be used.

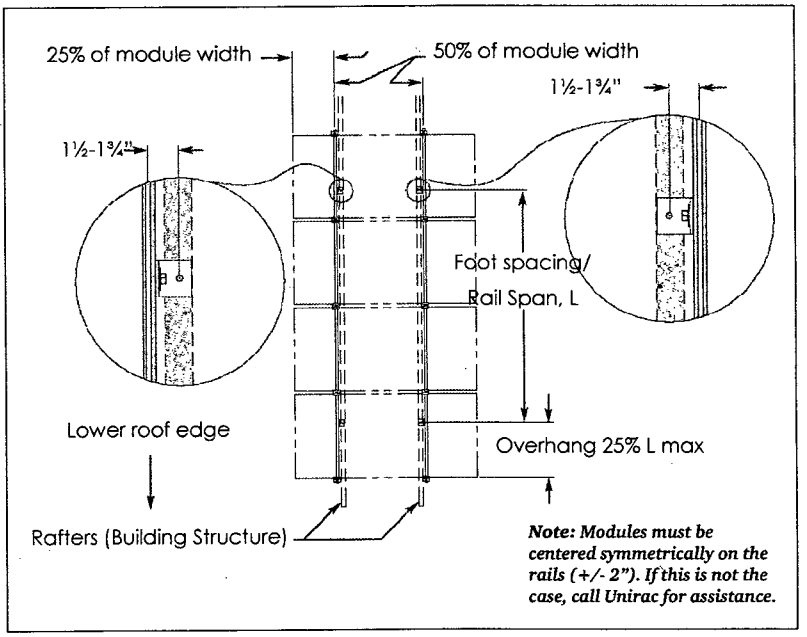


Figure 9. Layout with rails parallel to rafters.

[3.2.3] Laying out standoffs

Standoffs (**Figure 10**) are used to increase the height of the array above the surface of the roof. Pair each standoff with a flashing to seal the lag bolt penetrations to the roof.

Use **Figure 11 or 12** to locate and mark the location of the standoff lag screw holes within the installation area.

Remove the tile or shake underneath each standoff location, exposing the roofing underlayment. Ensure that the standoff base lies flat on the underlayment, but remove no more material than required for the flashings to be installed properly.

The standoffs must be firmly attached to the building structure.

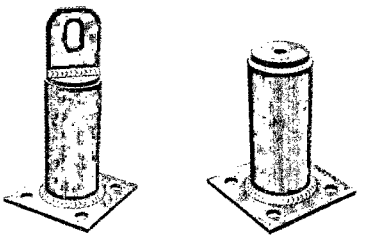
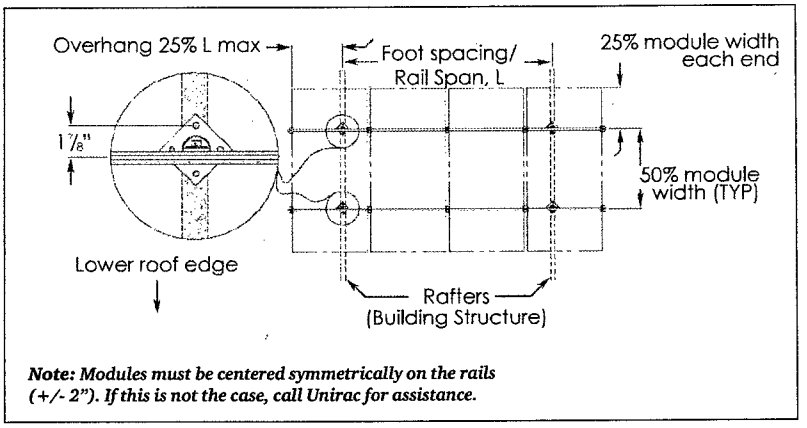
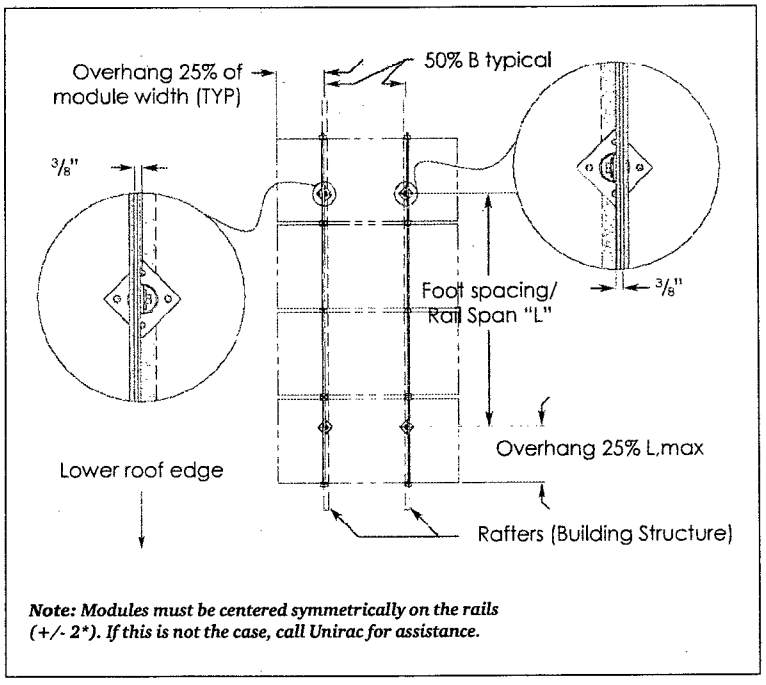


Figure 10. Raised flange standoff (left) and flat top standoff used in conjunction with an L-foot.



***Note:** Modules must be centered symmetrically on the rails (+/- 2"). If this is not the case, call Unirac for assistance.*

Figure 11. Layout with rails perpendicular to rafters.perpendicular to rafters.



***Note:** Modules must be centered symmetrically on the rails (+/- 2"). If this is not the case, call Unirac for assistance.*

Figure 12. Layout with rails parallel to rafters.

If multiple high-profile rows are to be installed adjacent to each other, it may not be possible for each row to be centered above the rafters. Adjust as needed, following the guidelines of **Fig. 12** as closely as possible.

Installing standoffs:

Drill 3/16 inch pilot holes through the underlayment into the center of the rafters at each standoff location. Securely fasten each standoff to the rafters with the two 5/16" lag screws.

Ensure that the standoffs face as shown in **Figure 11 or 12.**

Unirac steel and aluminum two-piece standoffs (1-5/8" O.D.) are designed for collared flashings available from Unirac.

Install and seal flashings and standoffs using standard building practices or as the company providing roofing warranty directs.

[3.2.4] Installing SolarMount rails

Keep rail slots free of roofing grit or other debris. Foreign matter will cause bolts to bind as they slide in the slots.

Installing Splices: If your installation uses SolarMount splice bars, attach the rails together (**Fig. 13**) before mounting the rails to the footings. Use splice bars only with flush installations or those that use low-profile tilt legs.

Although structural, the joint is not as strong as the rail itself. A rail should always be supported by ***more than one*** footing on ***both*** sides of the splice. (Reference installation manual 908, Splices/Expansion Joints.)

If using more than one splice per rail, contact Unirac concerning thermal expansion issues.

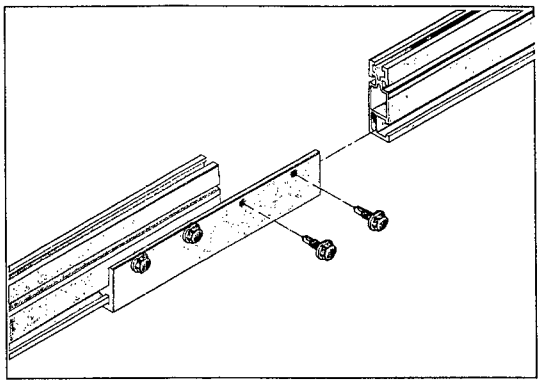


Figure 13. Splice bars slide into the footing bolt slots of SolarMount rail sections.

Mounting Rails on Footings: Rails may be attached to either of two mounting holes in the L-feet (**Fig. 14**). Mount in the lower hole for a low profile, more aesthetically pleasing installation. Mount in the upper hole for a higher profile, which will maximize airflow under the modules. This will cool them more and may enhance performance in hotter climates.

Slide the ⅜-inch mounting bolts into the footing bolt slots. Loosely attach the rails to the footings with the flange nuts.

Ensure that the rails are oriented to the footings as shown in **Figure 8, 9, 11, or 12,** whichever is appropriate.

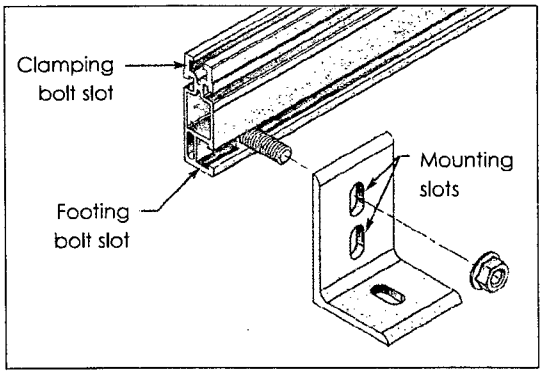


Figure 14. Foot-to-rail splice attachment

Aligning the Rail End: Align one pair of rail ends to the edge of the installation area (**Fig. 15 or Fig. 16**).

The opposite pair of rail ends will overhang the side of the installation area. Do not trim them off until the installation is complete.

If the rails are perpendicular to the rafters (**Fig. 15**), either end of the rails can be aligned, but the first module must be installed at the aligned end.

If the rails are parallel to the rafters (**Fig. 16**), the aligned end of the rails must face the lower edge of the roof. Securely tighten all hardware after alignment is complete (30 ft lbs).

Mount modules to the rails as soon as possible. Large temperature changes may bow the rails within a few hours if module placement is delayed.

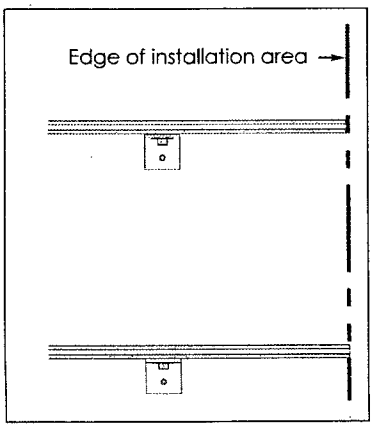


Figure 15. Rails perpendicular to the rafters.

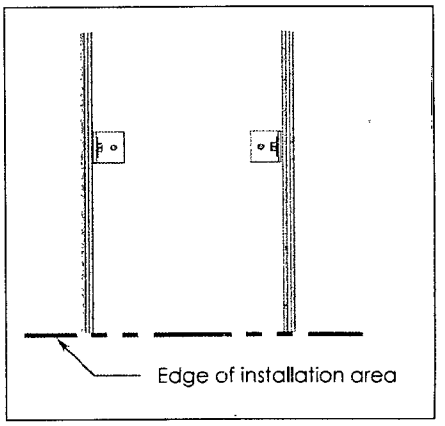


Figure 16. Rails parallel to the rafters.

[3.2.5] Installing the modules

Pre-wiring Modules: If modules are the Plug and Play type, no pre-wiring is required, and you can proceed directly to "Installing the First Module" below.

If modules have standard J-boxes, each module should be pre-wired with one end of the intermodule cable for ease of installation. For safety reasons, module pre-wiring should not be performed on the roof.

Leave covers off J-boxes. They will be installed when the modules are installed on the rails.

Installing the First Module: In high-profile installations, the safety bolt and flange nut must be fastened to the module bolt slot at the aligned (lower) end of each rail. It will prevent the lower end clamps and clamping bolts from sliding out of the rail slot during installation.

If there is a return cable to the inverter, connect it to the first module. Close the J-box cover. Secure the first module with T-bolts and end clamps at the aligned end of each rail. Allow half an inch between the rail ends and the end clamps (**Fig.18**). Finger tighten flange nuts, center and align the module as needed, and securely tighten the flange nuts (10 ft lbs).

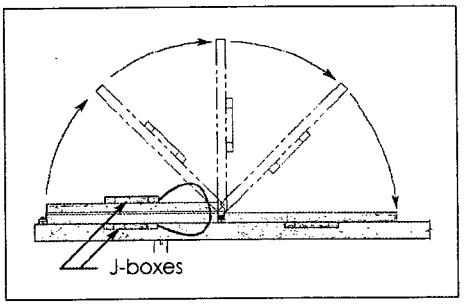


Figure 17

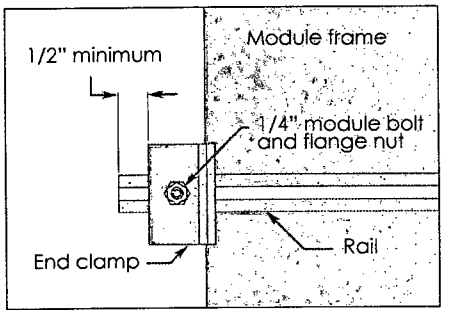


Figure 18

Installing the Other Modules: Lay the second module face down (glass to glass) on the first module. Connect intermodule cable to the second module and close the J-box cover. Turn the second module face up (**Fig. 17**). With T-bolts, mid-clamps and flange nuts, secure the adjacent sides of the first and second modules. Align the second module and securely tighten the flange nuts (**Fig. 19**).

For a neat installation, fasten wire management devices to rails with self-drilling screws.

Repeat the procedure until all modules are installed. Attach the outside edge of the last module to the rail with end clamps.

Trim off any excess rail, being careful not to cut into the roof. Allow half an inch between the end clamp and the end of the rail (**Fig. 18**).

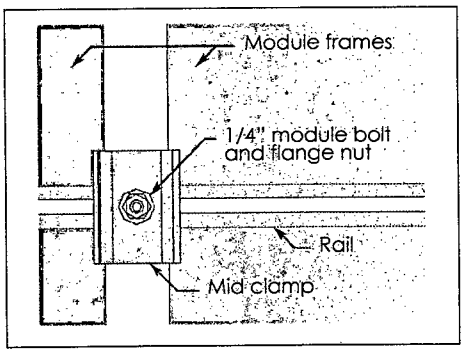


Figure 19

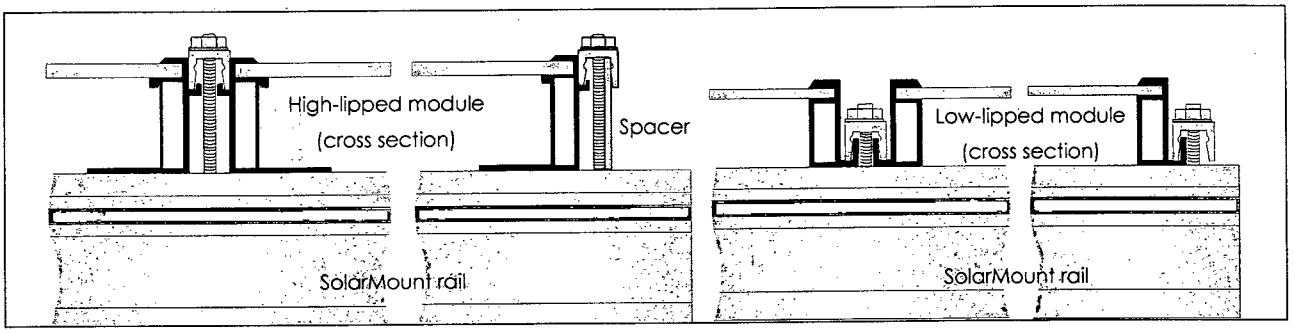


Figure 20. Mid clamps and end clamps for lipped-frame modules are identical. A spacer for the end clamps is necessary only if the lips are located high on the module frame.

[3.3] Installing SolarMount with bottom mounting clips

This section covers SolarMount rack assembly where the installer has elected to use bottom mounting clamps to secure modules to the rails. It details the procedure for flush mounting SolarMount systems to a pitched roof.

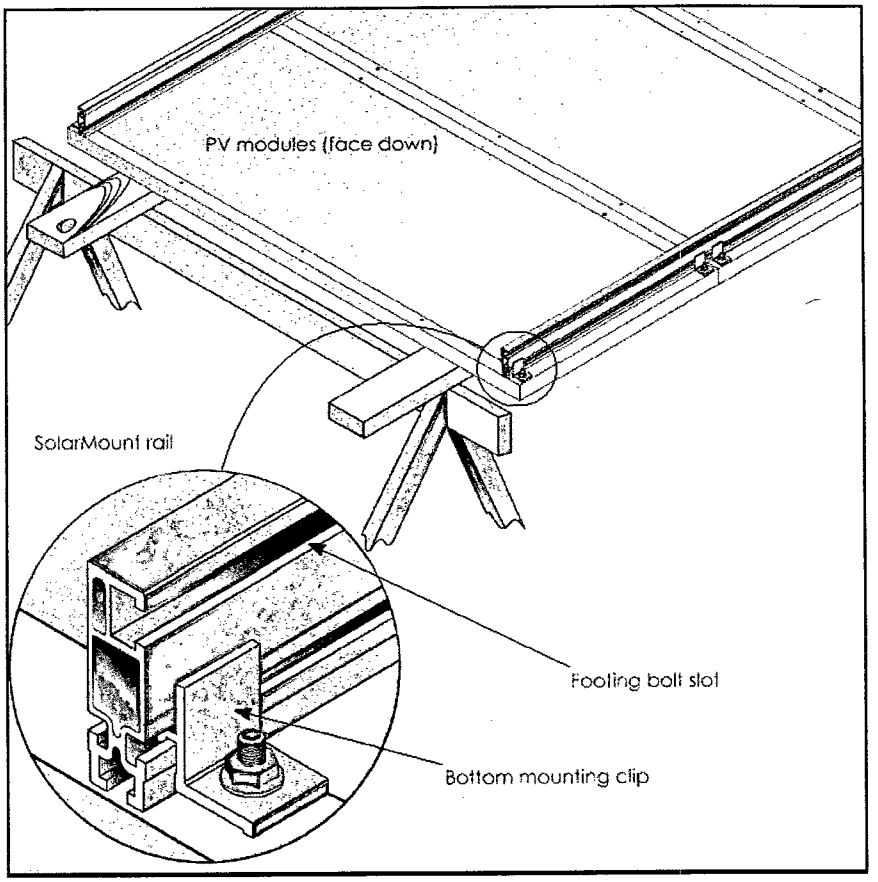


Figure 21. SMR and CB components

Table 16. Wrenches and torque

	Wrench size	*Recommended torque (ft-lbs)*
¼" hardware	7/16"	10
⅜" hardware	9/16"	30

Note:Torque specifications do not apply to lag bolt connections.

Stainless steel hardware can seize up, a process called galling. To significantly reduce its likelihood, (1) apply lubricant to bolts, preferably an anti-seize lubricant, available at auto parts stores, (2) shade hardware prior to installation, and (3) avoid spinning on nuts at high speed. See Installation Supplement 910, Galling and Its Prevention, at www.unirac.com.

[3.3.1] Planning the installation area

Decide on an arrangement for clips, rails, and L-feet (**Fig. 22**).

Use Arrangement A if the full width of the rails contacts the module. Otherwise use Arrangement B.

Caution: If you choose Arrangement B, either (1) use the upper mounting holes of the L-feet or (2) be certain that the L-feet and clip positions don't conflict.

If rails must be parallel to the rafters, it is unlikely that they can be spaced to match rafters. In that case, add structural supports – either sleepers over the roof or mounting blocks beneath it. These additional members must meet code; if in doubt, consult a professional engineer.

Never secure the footings to the roof decking alone. Such an arrangement will not meet code and leaves the installation and the roof itself vulnerable to severe damage from wind.

Leave enough room to safely move around the array during installation. The width of a rail-module assembly equals the length of one module. Note that L-feet may extend beyond the width of the assembly by as much as 2 inches on each side. The length of the assembly equals the total width of the modules.

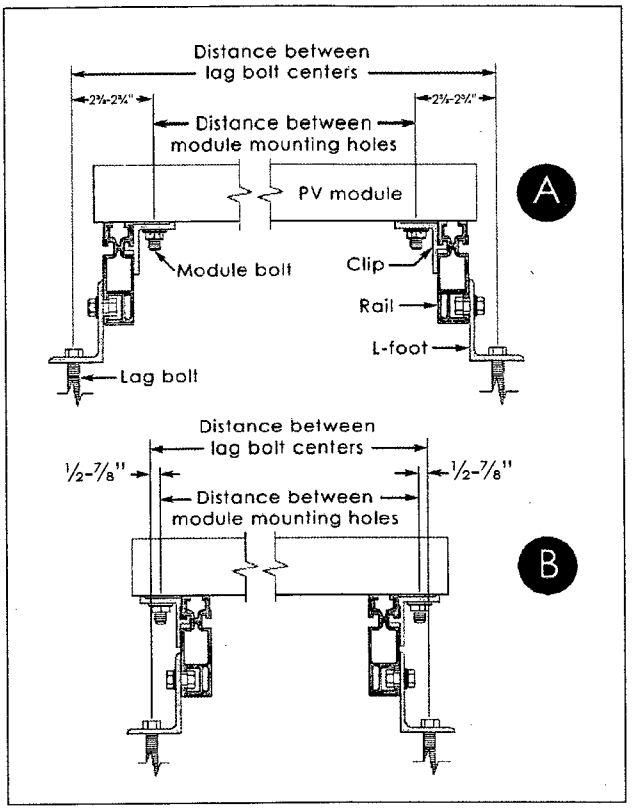


Figure 22. Clip Arrangements A and B

[3.3.2] Laying out the installing L-feet

L-feet are used for installation through existing low profile roofing material, such as asphalt shingles or sheet metal. They are also used for most ground mount installations. To ensure that the L-feet will be easily accessible during flush installation:

- Use the PV module mounting holes nearest the ends of the modules.
- Situate the rails so that footing bolt slots face outward.

The single slotted square side of the L-foot must always lie against the roof with the double-slotted side perpendicular to the roof.

Foot spacing (along the same rail) and rail overhang depend on design wind loads.

Install half the L-feet:

- If rails are perpendicular to rafters (**Fig. 23**), install the feet closest to the lower edge of the roof.
- If rails are parallel to rafters (**Fig. 24**), install the feet for one of the rails, but not both.

For the L-feet being installed now, drill pilot holes through the roofing into the center of the rafter at each lag screw hole location.

Squirt sealant into the hole and onto the shafts of the lag screws. Seal the underside of the L-feet with a sealant. Securely fasten the L-feet to the building structure with the lag screws. Ensure that the L-feet face as shown in **Figure 23 or Figure 24.**

Hold the rest of the L-feet and fasteners aside until the panels are ready for the installation.

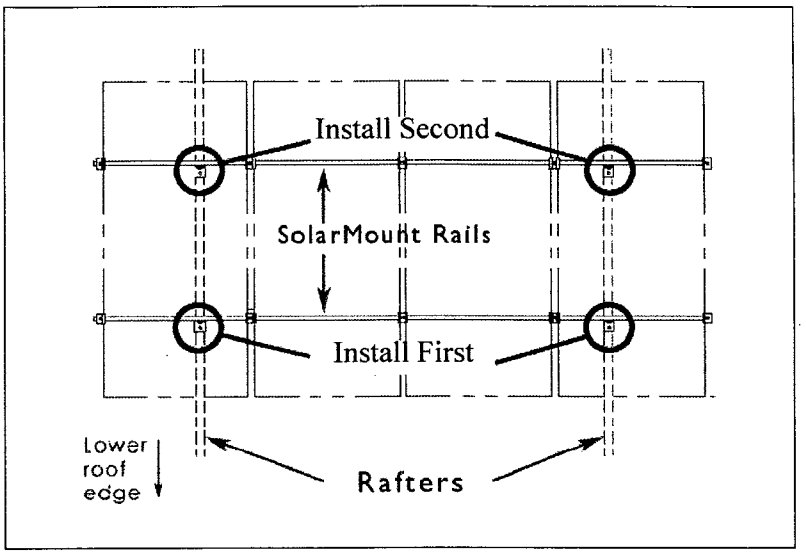


Figure 23. Layout with rails perpendicular to rafters.

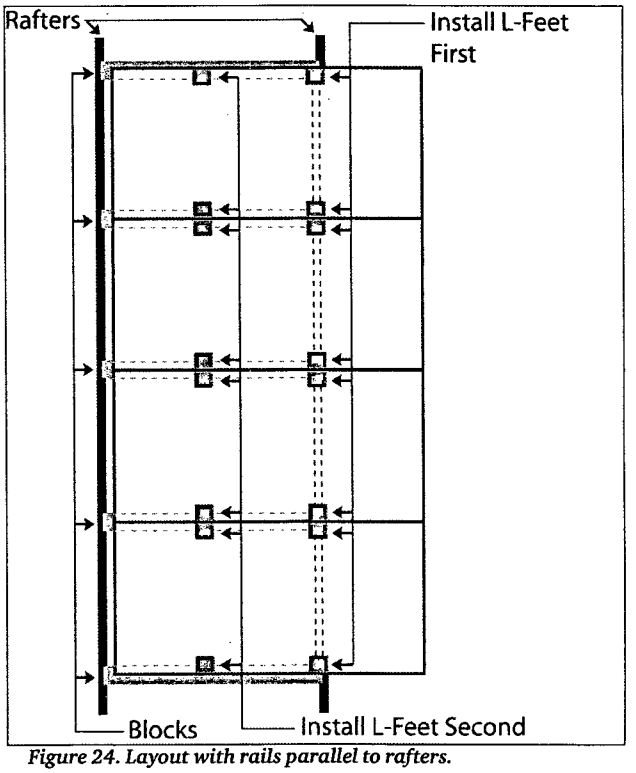


Figure 24. Layout with rails parallel to rafters.

[3.3.3] Attaching modules to the rails

Lay the modules for a given panel face down on a surface that will not damage the module glass. Align the edges of the modules and snug them together (**Fig. 21, page 22**).

Trim the rails to the total width of the modules to be mounted. Place a rail adjacent to the outer mounting holes. Orient the footing bolt slot outward. Place a clip slot adjacent to the mounting holes, following the arrangement you selected earlier.

Assemble the clips, mounting bolts, and flange nuts. Torque the flange nuts to 10 foot-pounds.

[3.3.4] Installing the module-rail assembly

Bring the module-rail assembly to the installation site. Keep rail slots free of debris that might cause bolts to bind in the slots.

Consider the weight of a fully assembled panel. Unirac recommends safety lines whenever lifting one to a roof.

Align the panel with the previously installed L-feet. Slide 3/8 inch L-foot mounting bolts onto the rail and align them with the L-feet mounting holes. Attach the panel to the L-feet and finger tighten the flange nuts.

Rails may be attached to either of two mounting holes in the footings (**Fig. 25**).

- Mount in the lower hole for a low, more aethetically pleasing installation.
- Or mount in the upper hole to maximize a cooling airflow under the modules. This may enhance performance in hotter climates.

Adjust the position of the panel as needed to fit the installation area. Slide the remaining L-feet bolts onto the other rail, attach L-feet, and finger tighten with flange nuts. Align L-feet with mounting holes previously drilled into the roof. Install lag bolts into remaining L-feet as described in "Laying out and installing L-feet" above.

Torque all footing flange nuts to 20 foot-pounds. Verify that all lag bolts are securely fastened.

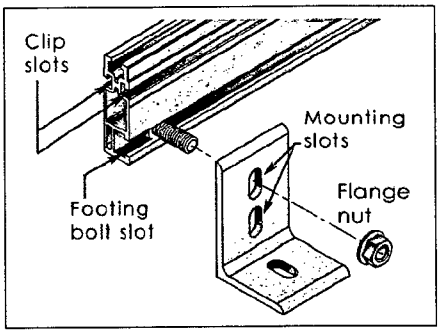
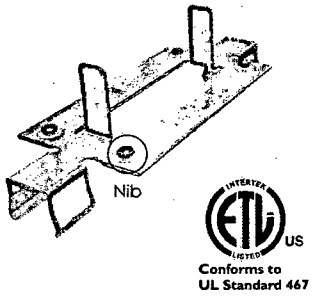


Figure 25. Leg-to-rail attachment

[3.4] Installing SolarMount with grounding clips and lugs

Clips and lugs are sold separately.

UGC-1



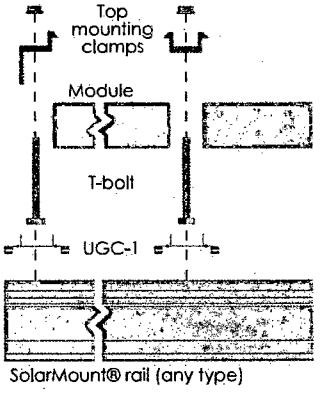


Figure 26. Slide UGC-1 grounding clip into top mounting slot of rail. Torque modules in place on top of clip. Nibs will penetrate rail anodization and create grounding path through rail (see Fig. 3, reverse side).

WEEBLug

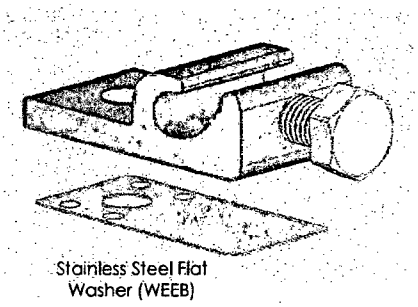


Figure 27. Insert a bolt in the aluminum rail or through the clearance hole in the stainless steel flat washer. Place the stainless steel flat washer on the bolt, oriented so the dimples will contact the aluminum rail. Place the lug portion on the bolt and stainless steel flat washer. Install stainless 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.

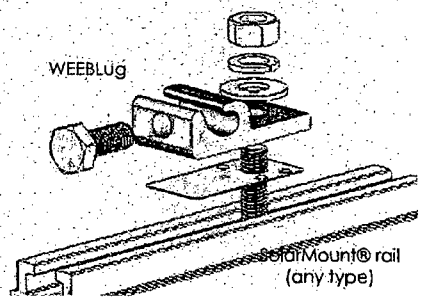
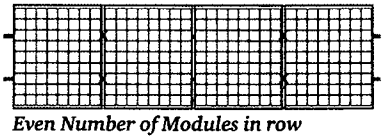
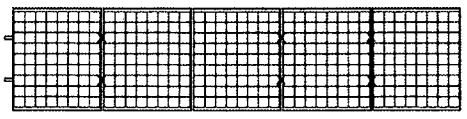


Figure 28. UGC-1 layout for even and odd number of modules in row. "X" denotes places to install UGC-1.

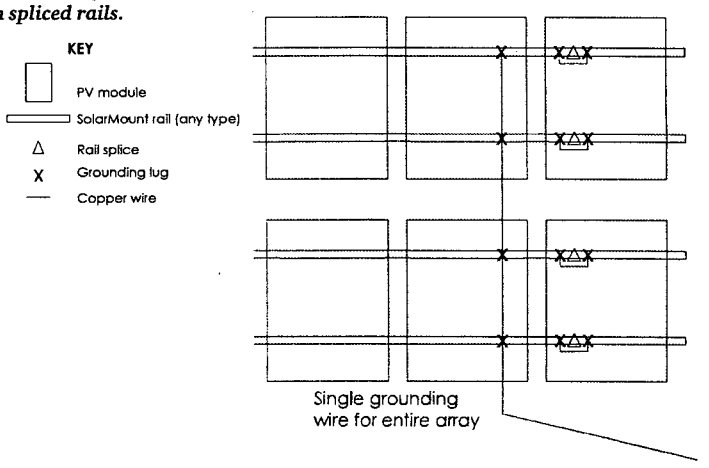


Even Number of Modules in row



Odd Number of Modules in row

Figure 29. Single wire grounding with spliced rails.



10 year limited Product Warranty, 5 year limited Finish Warranty

Unirac, Inc., warrants to the original purchaser ("Purchaser") of product(s) that it manufactures ("Product") at the original installation site that the Product shall be free from defects in material and workmanship for a period of ten (10) years, except for the anodized finish, which finish shall be free from visible peeling, or cracking or chalking under normal atmospheric conditions for a period of five (5) years, from the earlier of 1) the date the installation of the Product is completed, or 2) 30 days after the purchase of the Product by the original Purchaser ("Finish Warranty").

The Finish Warranty does not apply to any foreign residue deposited on the finish. All installations in corrosive atmospheric conditions are excluded. The Finish Warranty is VOID if the practices specified by AAMA 609 & 610-02 – "Cleaning and Maintenance for Architecturally Finished Aluminum" (www.aamanet.org) are not followed by Purchaser. This Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation.

This Warranty shall be VOID if installation of the Product is not performed in accordance with Unirac's written installation instructions, or if the Product has been modified, repaired, or reworked in a manner not previously authorized by Unirac IN WRITING, or if the Product is installed in an environment for which it was not designed. Unirac shall not be liable for consequential, contingent or incidental damages arising out of the use of the Product by Purchaser under any circumstances.

If within the specified Warranty periods the Product shall be reasonably proven to be defective, then Unirac shall repair or replace the defective Product, or any part thereof, in Unirac's sole discretion. Such repair or replacement shall completely satisfy and discharge all of Unirac's liability with respect to this limited Warranty. Under no circumstances shall Unirac be liable for special, indirect or consequential damages arising out of or related to use by Purchaser of the Product.

Manufacturers of related items, such as PV modules and flashings, may provide written warranties of their own. Unirac's limited Warranty covers only its Product, and not any related items.

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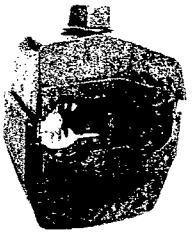
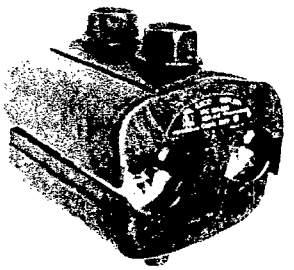
Eliminates need for conductor insulation stripping
No taping required after installation
For copper to copper, copper to aluminum, or aluminum to aluminum applications
For use on insulated conductor only

UL LISTED CSA

CU9AL
90°C





IPC SERIES

NAED NUMBER	CATALOG NUMBER	WIRE RANGE MAIN	WIRE RANGE TAP	VOLTS	BOLTS	TORQUE FT-LBS	CTN QTY	EST. SHIPPING WEIGHT (lbs)	EST. SHIPPING UNIT
13110	**IPC 1002**	1/0 - 8	2 - 8	300	1	16	12	2.63	CTN
13107	***IPC 4006**	4/0 - 4	6 - 14	600	1	13	12	1.90	CTN
13108	***IPC 4020**	4/0 - 2	2/0 - 6	600	1	25	12	4.08	CTN
13109	***IPC 2540**	250 - 1	4/0 - 6	600	1	30	6	4.17	CTN
13113	**IPC 3540**	350 - 4/0	4/0 - 10	300	1	25	6	4.17	CTN
13114	**IPC 3535**	350 - 4/0	350 - 4/0	300	2	25	6	7.63	CTN
13116	†**IPC 5012**	500 - 250	10 - 12	300	1	25	4	2.85	CTN
13104	***IPC 5025**	500 - 250	250 - 4	600	1	55	4	4.06	CTN
13105	***IPC 5050**	500 - 300	500 - 250	600	1	75	1	2.64	EA
13106	***IPC 7550**	750 - 500	500 - 350	600	1	75	1	2.62	EA

*600 Volts, balance 300 Volts (for 480V grounded Y systems)
† Not CSA certified

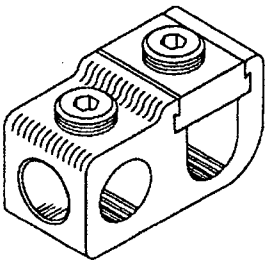
CAUTION
Use Bug•Bites on insulated cable only!
Do not install on bare cable.

GUTTER TAP CONNECTORS

UL LISTED CSA

Dual-Rated
CU9AL
600V 90°C

High strength aluminum alloy 6061-T6, tin-plated
Lay-in designed main conductor remains continuous
Tap parallel or perpendicular to main



For copper-to-copper, copper-to-aluminum, aluminum-to-aluminum

GP SERIES

NAED NUMBER	CATALOG NUMBER	CONDUCTOR RANGE MAIN	CONDUCTOR RANGE TAP	APPROX. DIMENSIONS (IN) H	W	L	CTN QTY	EST. SHIPPING WEIGHT (lbs)	EST. SHIPPING UNIT
13117	**GP 2***	2 - 12	4 - 12 SOL	7/8	5/8	$1^{25}/_{64}$	24	1.43	CTN
13118	**GP 10**	1/0 - 2	1/0 - 12 SOL	1	3/4	$1^{3}/_{4}$	12	1.19	CTN
13119	**GP 250**	250 - 1/0	250 - 6	$1^{5}/_{16}$	$1^{1}/_{16}$	$2^{9}/_{32}$	12	2.54	CTN
13121	**GP 350**	350 - 4/0	350 - 6	$1^{7}/_{16}$	$1^{1}/_{4}$	$2^{9}/_{16}$	6	2.75	CTN
13122	**GP 500**	500 - 350	500 - 2	$1^{3}/_{4}$	$1^{3}/_{8}$	$3^{1}/_{8}$	6	3.10	CTN
13123	**GP 750**	750 - 500	500 - 2	2	$1^{1}/_{2}$	$3^{3}/_{8}$	3	2.5	CTN

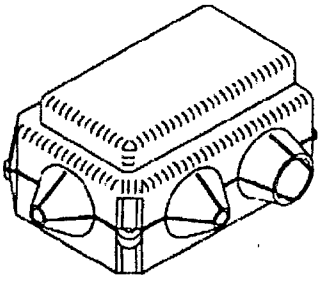
*GP2 has slotted screws.
Oxide-inhibitor is recommended for added corrosion protection.

600V 90°C
For indoor use only

Snap-on insulating covers for use with GP connectors

GPC SERIES

NAED NUMBER	CATALOG NUMBER	FOR USE WITH CONNECTOR	COLOR	APPROX. DIMENSIONS (IN) H	W	L	CTN QTY	EST. SHIPPING WEIGHT (lbs)	EST. SHIPPING UNIT
13137	**GPC 2**	GP2	YELLOW	$1^{7}/_{64}$	$1^{29}/_{32}$	$1^{7}/_{32}$	12	0.46	CTN
13138	**GPC 10**	GP1/0	GRAY	$1^{1}/_{4}$	$2^{5}/_{32}$	$2^{5}/_{8}$	6	0.36	CTN
13140	**GPC 250**	GP250	RED	$1^{5}/_{8}$	$2^{7}/_{8}$	$3^{7}/_{16}$	6	0.40	CTN
13141	**GPC 350**	GP350	YELLOW	$1^{3}/_{4}$	$3^{3}/_{16}$	$3^{3}/_{4}$	3	0.42	CTN
13142	**GPC 500**	GP500	BLUE	$2^{3}/_{32}$	$3^{5}/_{16}$	$4^{3}/_{8}$	3	0.46	CTN
13134	**GPC 750**	GP750	ORANGE	$2^{11}/_{32}$	$3^{7}/_{16}$	$4^{5}/_{8}$	3	0.65	CTN



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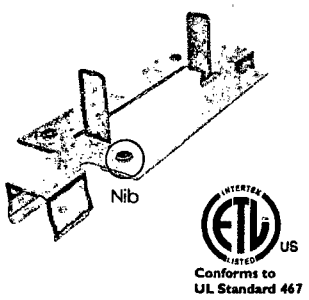
[3.4] Installing SolarMount with grounding clips and lugs

Clips and lugs are sold separately.

UGC-1



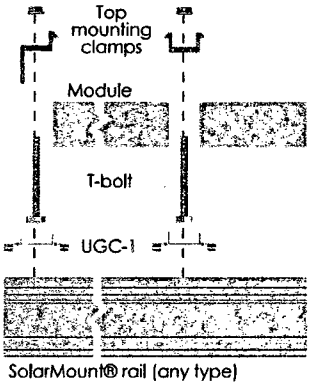
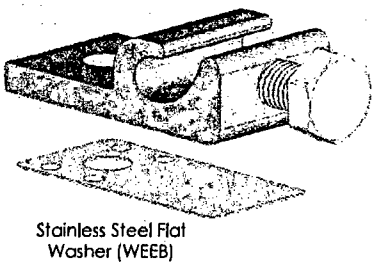


Figure 26. Slide UGC-1 grounding clip into top mounting slot of rail. Torque modules in place on top of clip. Nibs will penetrate rail anodization and create grounding path through rail (see Fig. 3, reverse side).

WEEBLug



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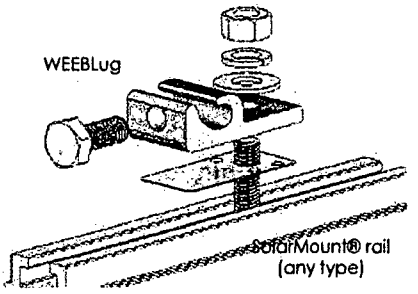

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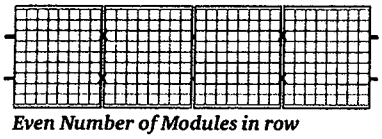
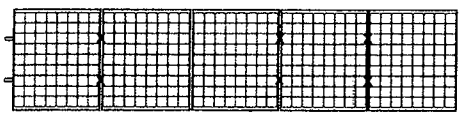
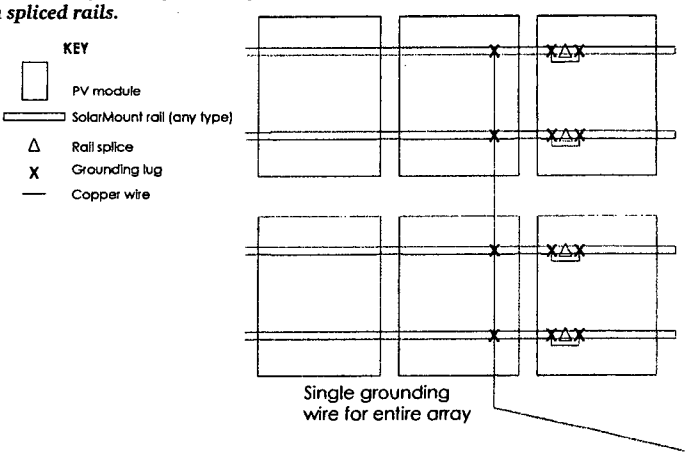


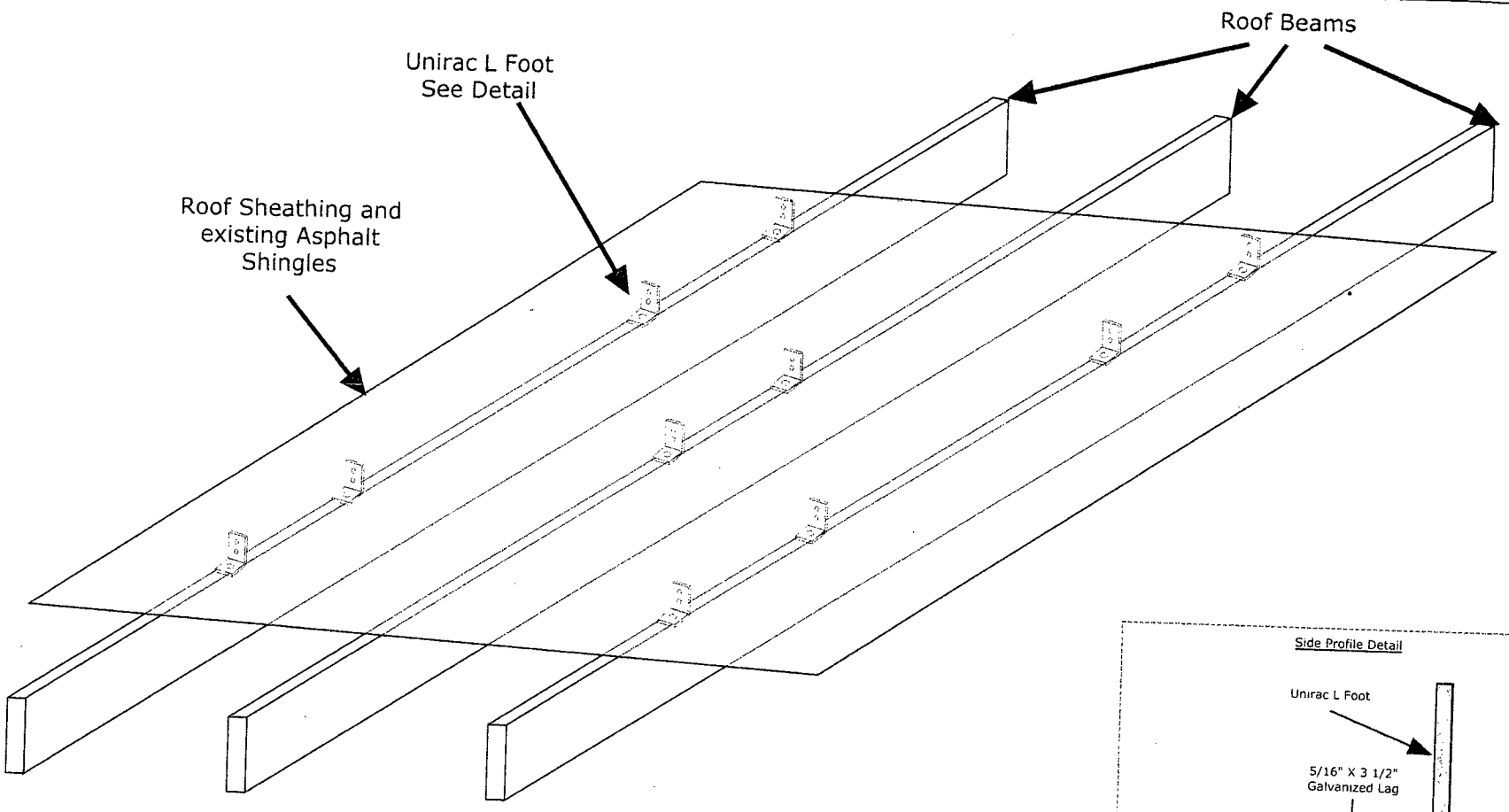
Even Number of Modules in row

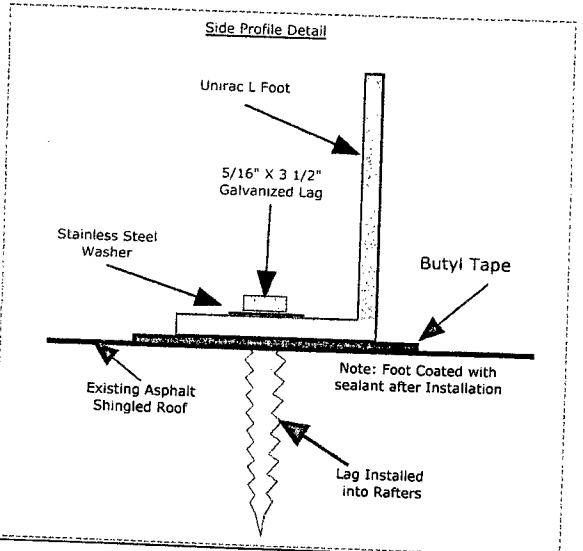


Odd Number of Modules in row

Figure 29. Single wire grounding with spliced rails.







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Freehold, NJ 07728
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Roof Penetrations and Foot spacing as per Unirac Specs

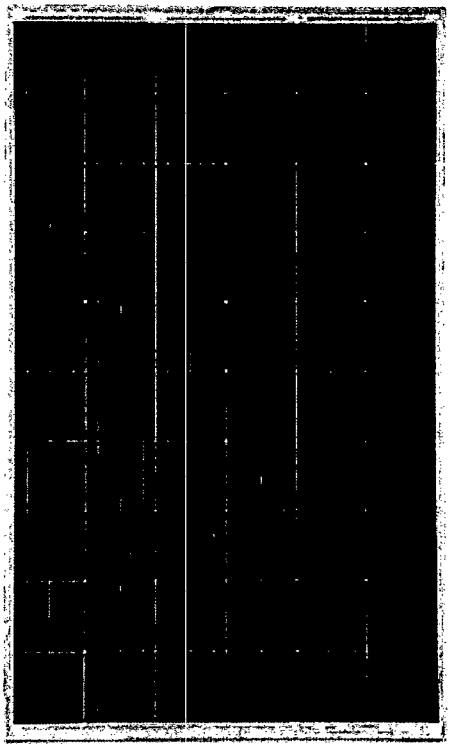
Block:_____
Lot:_____

Roof Atachment Detail

MULTI

TSM-PA05

The Universal Solution



- Easy installation and handling for various applications
- Module can bear snow loads (5400PA) and wind loads (2400PA)
- Guaranteed power output (0~+3%)
- High performance under low light conditions (Cloudy days, mornings and evenings)
- Independently certified by international certification body*
- Manufactured according to International Quality and Environment Management System (ISO9001, ISO14001)

Currently the most popular panel produced by Trina Solar. Versatile and adaptable, with power output ranging from 220 to 240Wp, the TSM-PA05 panel is perfect for large-scale installations, particularly ground-mounted and commercial rooftop systems. Using reliable and carefully selected components that are tested at the Trina Solar Center of Excellence, this panel comes with a 25-year performance guarantee of 80% power production.

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Founded in 1997, Trina Solar is a vertically integrated PV manufacturer, producing everything from ingots to modules, using both mono and multicrystalline technologies. At the end of 2010, the company will have a nameplate module capacity of 950MW. Trina Solar's wide range of products are used in residential, commercial, industrial and public utility applications throughout the world.

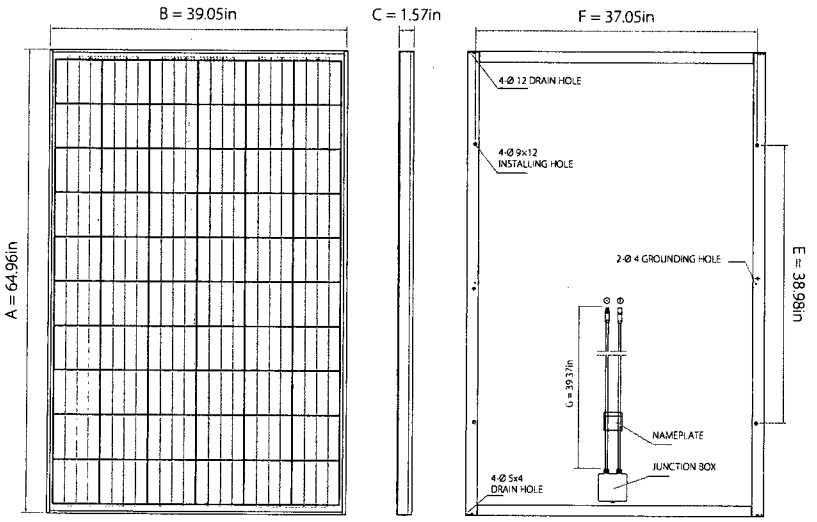
Only by matching an efficient cost-structure with proven performance will we, as an industry, achieve grid parity. And at Trina Solar, we have both.

Trinasolar
The power **behind** the panel

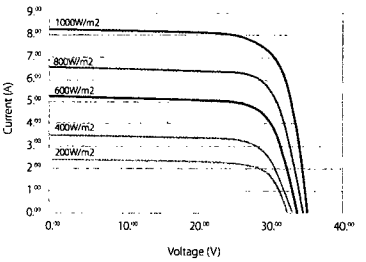
* IEC61215, IEC61730, UL1703, TUV Safety Class II, CE

TSM-PA05 The Universal Solution

Dimensions of PV module TSM-PA05



I-V Curves of PV module TSM-230PA05



Efficiency	up to 14.7
Wattage	up to 240
Years warranty	25

Certification

Electrical Data @ STC	TSM-220PA05	TSM-225PA05	TSM-230PA05	TSM-235PA05	TSM-240PA05
Peak Power Watts-P_{MAX} (WP)	220	225	230	235	240
Power Output Tolerance-P_{MAX} (%)	0/+3	0/+3	0/+3	0/+3	0/+3
Maximum Power Voltage-V_{MAX} (V)	29.0	29.4	29.8	30.1	30.4
Maximum Power Current-I_{MPP} (A)	7.60	7.66	7.78	7.81	7.89
Open Circuit Voltage-V_{OC} (V)	36.8	36.9	37.0	37.1	37.2
Short Circuit Current-I_{SC} (A)	8.15	8.20	8.26	8.31	8.37
Encapsulated Cell Efficiency η_c (%)	15.1	15.4	15.8	16.1	16.4
Module Efficiency η_m (%)	13.4	13.7	14.1	14.4	14.7

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

General Data

Cell Type	6 x 6in Multicrystalline silicon, 60pcs (6x10)
Glass	High Transmission, Low Iron, Tempered Glass 0.13in
Frame	Anodized Aluminum
J-Box / Connector	1. Tyco / Tyco, IP65 2. Renhe / MC4, IP65

Temperature Ratings

Nominal Operating Cell Temperature (NOCT)	46°C (±2°C)
Temperature Coefficient of P_{MPP}	- 0.45%/°C
Temperature Coefficient of V_{OC}	- 0.35%/°C
Temperature Coefficient of I_{SC}	0.05%/°C

Mechanical and Packing Configuration

Dimensions (A x B X C)	64.96 x 39.05 x 1.57in
Installation Hole Dimensions (E x F)	38.98 x 37.05in
Cable length (G)	39.37in
Weight	43.0lb
Packing Configuration	25pcs/carton
Quantity/Pallet	1carton/pallet
Loading Capacity	650pcs/40ft(H)

Maximum Ratings

Operating Temperature	-40 ~ +85°C
Storage Temperature	-40 ~ +85°C
Maximum System Voltage	600VDC
Maximum Series Fuse	15A

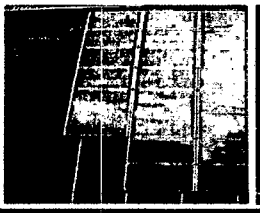
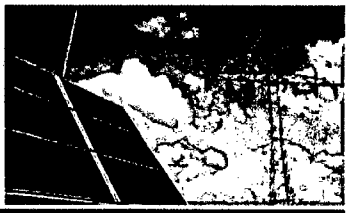
Warranty

5 years manufacturing warranty
10 years warranty, 90% power output
25 years warranty, 80% power output

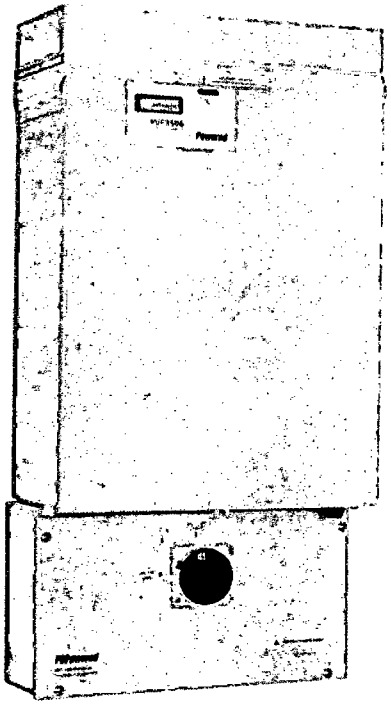
CAUTION: READ SAFETY AND INSTALLATION INSTRUCTIONS BEFORE USING THE PRODUCT.

Trinasolar
www.trinasolar.com

PV Powered®
AN AE ADVANCED ENERGY COMPANY

PVP2000 to PVP5200 String Inverters



Proven Reliability – With Integrated AC and DC PV System Disconnect Listed to the UL 98 Standard

PV Powered, Inc. continues to deliver industry-leading reliability and technical innovations that lower the total cost of PV systems installation. PV Powered is now the only manufacturer of a residential inverter-integrated AC/DC PV System Disconnect that is listed to the UL 98 Standard. The UL 98 Standard, called "Enclosed and Dead-front Switches," ensures the integrated PV Powered disconnect meets all installation and inspection requirements of a PV System Disconnect.

Housed within an NEC Compliant wire raceway, PV Powered's innovative disconnect consists of one enclosure with generous working room for installation. In addition to providing for a single point of connection from the utility service and PV array, the wire raceway's optimized knockout locations also provide options for side, bottom and back entry with minimized conduit bending. The wire raceway enables flush side-by-side mounting, eliminating the need for extra equipment and resulting in a cleaner, less expensive installation.

PV Powered's string inverters are backed by the industry's first nation-wide ten year warranty and equipment replacement program. Optional performance monitoring is available which includes low cost, secure web-based access to inverter status and performance history.

FEATURES

Industry-Leading Reliability

- Endurance tested to 20 year operating life
- Lowest part counts and fewest interconnects eliminate common failure points
- Field-proven technology with thousands of units installed nationwide

Integrated AC and DC PV System Disconnect

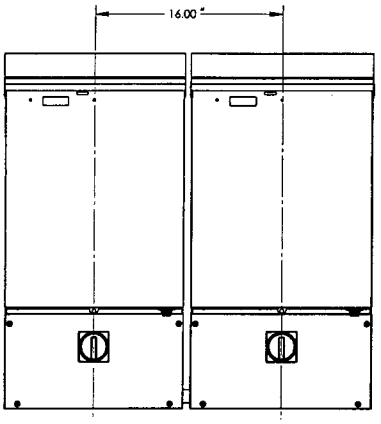
- Listed to UL 98 Standard for use with PV Powered UL 1741 Listed string inverters
- Robust testing of switch mechanism to UL 98 Standard
- Single AC/DC switch visible and lockable in the OFF position
- NEC Compliant internal wire raceway enables side-by-side mounting
- Direct-to-wall surface enclosure design allows for easy access and installation

Easy Installation

- Factory integrated inverter and PV System Disconnect eliminates the need for extra equipment
- Integrated disconnect reduces conduit connection points saving installation time and material cost
- Field-configurable positive ground applications with simple jumper selection
- Optimally placed knockouts for a variety of conduit routing options

Installer-Focused Support

- No special purchase requirements to get the best technical support in the industry
- Live technical phone support
- Economical performance monitoring options



Example of Side-by-side Mounting on Standard Stud Spacing

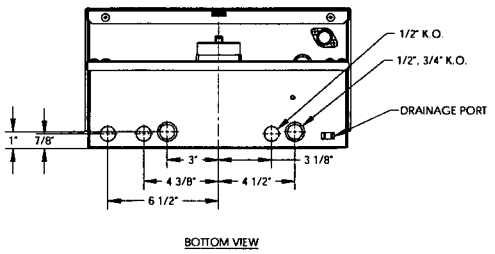
All PV Powered products are designed and manufactured in the U.S., are fully compliant with the Buy American Act, and qualify for projects funded by the federal stimulus package.

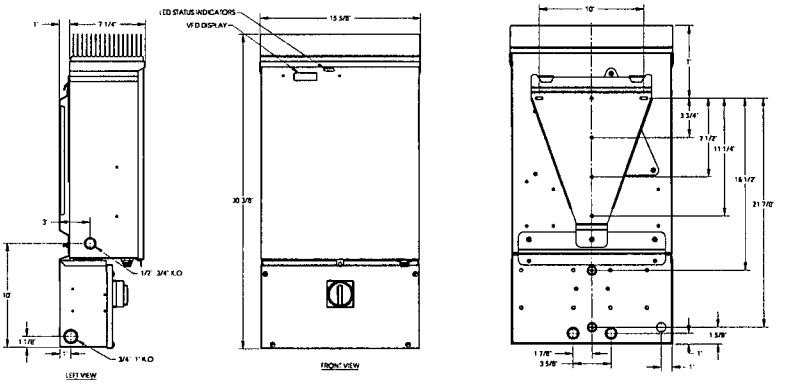
20720 Brinson Boulevard
PO Box 7348
Bend, OR 97708

1-541-312-3832
WWW.PVPOWERED.COM

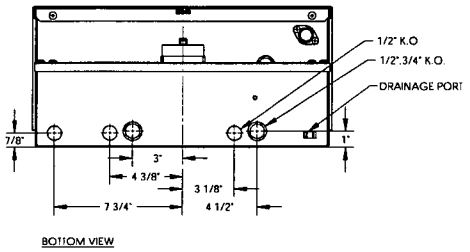
DIMENSIONS

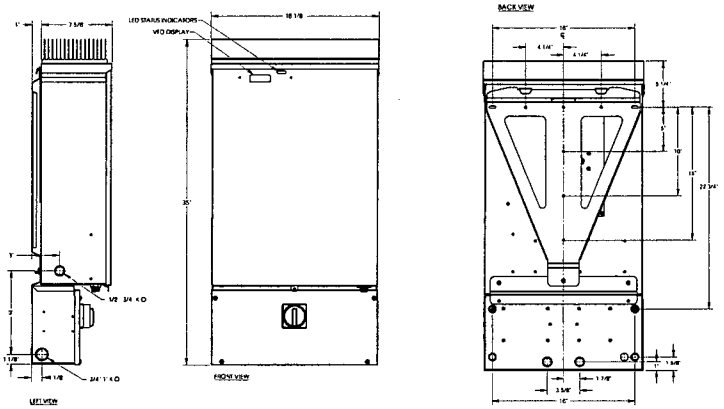
PVP2000 to PVP3500





PVP4600, PVP4800, PVP5200





Intertek

ELECTRICAL SPECIFICATIONS

MODEL	PVP2000	PVP2500	PVP2800	PVP3000	PVP3500	PVP4600	PVP4800	PVP5200
Continuous Output Power (watts)	2000	2500	2800	3000	3500	4600	4800	5200
Weighted CEC Efficiency (%)	92	94.5	92	93.5	95.5	95.5	96	96
Maximum DC Input Voltage (VOC)	500	500	500	500	500	500	500	500
DC Voltage Operating Range (V)	115-450	140-450	180-450	170-450	200-450	205-450	200-450	240-450
DC Minimum Start Voltage (V)	130	155	195	185	215	220	215	255
DC Maximum Current (A)	18.5	19	16.5	19	18.5	24	25.5	23
AC Rated Output Current (A)	8.5	10.5	13.5	12.5	15	22.5	20.5	22
AC Nominal Voltage (V)	240	240	208	240	240	208	240	240
AC Output Voltage Range (V)	211-264	211-264	183-229	211-264	211-264	183-229	211-264	211-264
AC Frequency Range (Hz)	59.3-60.5	59.3-60.5	59.3-60.5	59.3-60.5	59.3-60.5	59.3-60.5	59.3-60.5	59.3-60.5

MECHANICAL SPECIFICATIONS

MODEL	PVP2000	PVP2500	PVP2800	PVP3000	PVP3500	PVP4600	PVP4800	PVP5200
	Inverter with Factory-Integrated AC and DC PV System Disconnect							
	NEMA 3R Steel Enclosure, Wall Mounted with Bracket Included							
Temperature	-25°C to 40°C							
Weight (lbs) with Disconnect	92.5	106.5	106.5	106.5	120.5	162	162	162
Inverter with Disconnect Dimensions	30 3/8" H x 15 5/8" W x 8 1/4" D	30 3/8" H x 15 5/8" W x 8 1/4" D	30 3/8" H x 15 5/8" W x 8 1/4" D	30 3/8" H x 15 5/8" W x 8 1/4" D	30 3/8" H x 15 5/8" W x 8 1/4" D	35" H x 18 1/8" W x 8 5/8" D	35" H x 18 1/8" W x 8 5/8" D	35" H x 18 1/8" W x 8 5/8" D

AGENCY APPROVALS

MODEL	PVP2000	PVP2500	PVP2800	PVP3000	PVP3500	PVP4600	PVP4800	PVP5200
	UL 98 13th Edition, UL 1741 Nov 2005 Revision, CSA C22.2 107.1 2006 Revision, IEEE 1547 Compliant, FCC Class A & B							

BUILDING SUBCODE
TECHNICAL SECTION

Date Received / Control # 9/14/11

Date Issued / Permit # 11-3791

A. IDENTIFICATION—APPLICANT: COMPLETE ALL APPLICABLE INFORMATION. WHEN CHANGING CONTRACTORS, NOTIFY THIS OFFICE. CALL UTILITY DIG NO: 1-800-272-1000.

Block 1170.07 Lot 6 Qualification Code

Work Site Location [illegible]

[illegible]

Owner in Fee: [illegible]

Tel. [redacted] e-mail

Address [illegible]
street municipality zip code

Contractor: Trinity Heating & Air DBA Trinity Solar Tel. (732) 780-3779

Address 800 US Hwy 9 South e-mail TrinityHNA@aol.com

Freehold, NJ 07728

Contractor License No. or Builder Registration No. 13VH01244300 Exp. Date 12-31-11

Home Improvement Contractor Registration No. or Exemption Reason (if applicable):

Federal Emp. ID No. 223292324 FAX: (732) 780-6671

JOB SUMMARY (Office Use Only)

PLAN REVIEW	Date	Initial
[ ] No Plans Required		
[✓] All	9.21.11	TH
[ ] Footings/Foundations		
[ ] Structural/Framework		
[ ] Exterior		
[ ] Interior		

Joint Plan Review Required:
[ ] Elec. [ ] Plumb. [ ] Fire [ ] Elevator

SUBCODE APPROVAL for PERMIT
Date:
Approved by:

SUBCODE APPROVAL for CERTIFICATE
[ ] CO [ ] CCO [ ] CA
Date:
Approved by:

INSPECTIONS Type:	Failure	Failure	Approval	Initial
	Dates (Month/Day)			
Footing				
Footing Bonding				
Foundation				
Slab				
Frame				
Truss Sys./Bracing				
Barrier-Free				
Insulation				
Finishes -Base Layer				
Finishes -Final				
Energy				
Mechanical				
TCO				
Other				
Final				
Barrier-Free				

B. BUILDING CHARACTERISTICS

Use Group Present _____ Proposed _____

No. of Stories _____

Height of Structure _____ ft.

Area — Largest Floor _____ sq. ft.

New Bldg. Area/All Floors _____ sq. ft.

Volume of New Structure _____ cu. ft.

Max. Live Load _____

Max. Occupancy Load _____

Constr. Class Present _____ Proposed _____

If Industrialized Building:
State Approved _____ HUD _____

Est. Cost of Bldg. Work:
1. New Bldg. $ _____
2. Rehabilitation $ _____
3. Total (1+ 2) $ 2,150

C. CERTIFICATION IN LIEU OF OATH

I hereby certify that I am the (agent of) owner of record and am authorized to make this application.

Sign here: [signature]

Print name here: [illegible]

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK

[illegible]

TYPE OF WORK:
- [ ] New Building
- [ ] Addition
- [ ] Rehabilitation
- [ ] Roofing
- [ ] Siding
- [ ] Fence _____ Height (exceeds 6')
- [ ] Sign _____ Sq. Ft.
- [ ] Pool
- [ ] Retaining Wall _____ Sq. Ft.
- [ ] Asbestos Abatement Subchapter 8
- [ ] Lead Haz. Abatement NJAC 5:17
- [ ] Radon Remediation
- [✓] Other [illegible]
- [ ] Demolition

FEE (Office Use Only)

$ _____

Administrative Surcharge $ _____
Minimum Fee $ _____
State Permit Surcharge Fee $ _____
TOTAL FEE $ _____

BUILDING SUBCODE
TECHNICAL SECTION

NEW JERSEY UNIFORM CONSTRUCTION CODE

Date Received
Control # 1/14/11

Date Issued
Permit # 1/21/11

A. IDENTIFICATION—APPLICANT: COMPLETE ALL APPLICABLE INFORMATION. WHEN CHANGING CONTRACTORS, NOTIFY THIS OFFICE. CALL UTILITY DIG NO: 1-800-272-1000.

Block _____ Lot _____ Qualification Code _____

Work Site Location _____

Owner in Fee: _____

Tel. ( ) _____ e-mail _____

Address _____
street municipality zip code

Contractor: Trinity Heating & Air DBA Trinity Solar Tel. (732) 780-3779

Address 800 US Hwy 9 South e-mail TrinityHNA@aol.com

Freehold, NJ 07728

Contractor License No. or Builder Registration No. 13VH01244300 Exp. Date 12-31-11

Home Improvement Contractor Registration No. or Exemption Reason (if applicable): _____

Federal Emp. ID No. 223292324 FAX: (732) 780-6671

JOB SUMMARY (Office Use Only)

PLAN REVIEW	Date	Initial
[ ] No Plans Required		
[ ] All		
[ ] Footings/Foundations		
[ ] Structural/Framework		
[ ] Exterior		
[ ] Interior		

Joint Plan Review Required:
[ ] Elec. [ ] Plumb. [ ] Fire [ ] Elevator

SUBCODE APPROVAL for PERMIT
Date: _____
Approved by: _____

SUBCODE APPROVAL for CERTIFICATE
[ ] CO [ ] CCO [ ] CA
Date: _____
Approved by: _____

INSPECTIONS Type:	Dates (Month/Day) Failure	Failure	Approval	Initial
Footing				
Footing Bonding				
Foundation				
Slab				
Frame				
Truss Sys./Bracing				
Barrier-Free				
Insulation				
Finishes -Base Layer				
Finishes -Final				
Energy				
Mechanical				
TCO				
Other				
Final				
Barrier-Free				

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Use Group Present _____ Proposed _____

No. of Stories _____

Height of Structure _____ ft.

Area — Largest Floor _____ sq. ft.

New Bldg. Area/All Floors _____ sq. ft.

Volume of New Structure _____ cu. ft.

Max. Live Load _____

Max. Occupancy Load _____

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If Industrialized Building:
State Approved _____ HUD _____

Est. Cost of Bldg. Work:
1. New Bldg. $ _____
2. Rehabilitation $ _____
3. Total (1+ 2) $ _____

C. CERTIFICATION IN LIEU OF OATH

I hereby certify that I am the (agent of) owner of record and am authorized to make this application.

Sign here: _____

Print name here: _____

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DESCRIPTION OF WORK

TYPE OF WORK:
[ ] New Building
[ ] Addition
[ ] Rehabilitation
[ ] Roofing
[ ] Siding
[ ] Fence _____ Height (exceeds 6')
[ ] Sign _____ Sq. Ft.
[ ] Pool
[ ] Retaining Wall _____ Sq. Ft.
[ ] Asbestos Abatement Subchapter 8
[ ] Lead Haz. Abatement NJAC 5:17
[ ] Radon Remediation
[ ] Other _____
[ ] Demolition

FEE (Office Use Only)
$ _____

Administrative Surcharge $ _____
Minimum Fee $ _____
State Permit Surcharge Fee $ _____
TOTAL FEE $ _____

RAFTER STRESS CALCULATIONS FOR SHERRI DUNST, 151 WALTER ROAD, BRICK, NJ

July 27, 2011

TOTAL AREA OF 4 SOLAR MODULES FOR REPRESENTATIVE AREA LOADING

SOLAR MODULE AREA, TYP.	39.1" x 58.3"	=	15.83 SQ FT
TOTAL SOLAR MODULE AREA: FOR 4 MODULES	4 x 15.83 SQ FT	=	63.32 SQ FT
INTERMODULE SPACING:	0.5"		
TOTAL SPACING AREA:	0.5" x 58.3"	=	0.202 SQ FT
TOTAL PANEL AREA, TYPICAL:	63.32 + 0.404	=	63.724 SQ FT

MAX SOLAR PANEL LOADING DUE TO SNOW AND DEAD LOAD (MODULES & HARDWARE)

SNOW LIVE LOAD = (0.7)(30 PSF REFERENCE GROUND SNOW LOAD)		=	21 PSF
MODULES WEIGHT INCLUDING HARDWARE		=	4.33 PSF
MAX TOTAL LOAD:	25.33 PSF x 63.724 SQ FT	=	1614 LB

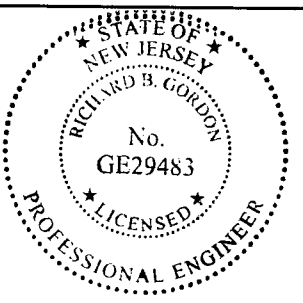
MAX LOADING PER SUPPORT (ATTACHMENT POINT) TO SNOW AND DEAD LOAD (MODULES & HARDWARE)

NUMBER OF SUPPORTS PER 4 MODULES = 4

LOAD PER SUPPORT:	1614 LB/4	=	538 LB

Optimize Engineering Co, LLC
P.O. Box 264•Farmville•VA 23901
(434) 574.6138; gmchardpe@aol.com
www.optimizeces.com

Richard B. Gordon, P.E.
N.J..P.E. Lic. No. 29483



RAFTER STRESS CALCULATIONS FOR SHERRI DUNST, 151 WALTER ROAD, BRICK, NJ

July 27, 2011

MAX SOLAR PANEL LOADING DUE TO WIND UPLIFT LOADING

@ 115 MPH WIND LOAD, UPLIFT: 19.6 PSF (SEE DERIVATION EQUATION)

MAX TOTAL LOAD: 19.6 PSF x 63.724 SQ FT = 1249 LB

MAX LOADING PER SUPPORT DUE TO WIND UPLIFT LOADING

NUMBER OF SUPPORTS PER 4 MODULES = 4

LOAD PER SUPPORT: 1249 LB/4 = 312 LB

TYPICAL ROOF LUMBER

Species	Specific Gravity	Lag Screw Withdraw Capacity for 5/16" dia. lb/in of thread	Withdrawl Capacity for 2" Of Thread
Doug Fir Larch	0.5	266	532
Doug Fir Larch (North)	0.49	258	516
Doug Fir South	0.46	235	470
Engelmann Spruce Lodgepole Pine (MSR 1650 F & higher Grades)	0.46	235	470
Hem Fir	0.43	212	424
Hem Fir (North)	0.46	235	470
Southern Pine	0.55	307	614
Spruce Pine Fir	0.42	205	410

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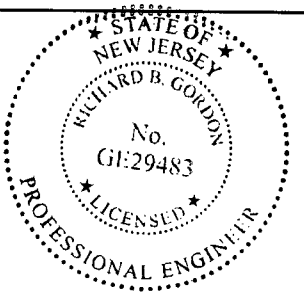

RAFTER STRESS CALCULATIONS FOR SHERRI DUNST, 151 WALTER ROAD, BRICK, NJ

July 27, 2011

Spruce Pine Fir (E=2x10**6 psi & higher grades Of MSR and MEL)	0.5	266	532

(Source: National Design Specification for Wood Construction and Universal Building Code)

CONCLUSION

THE SOFTEST WOOD USED IN FRAMING IS SPRUCE PINE FIR.

THE WITHDRAW REQUIRED TO PULL OUT A 5/16" DIA LAG SCREW IS 410 LB.

WE HAVE CALCULATED 312 LB POSSIBLE UNDER LOAD WHEN SUBJECTED TO AN UPLIFT FORCE OF 19.6 PSF.

THIS PROVIDES A 31.4 % SAFETY MARGIN OR A FACTOR OF SAFETY OF 410/312 = 1.314 FOR EXPOSURE CATEGORY B AND IS AN ACCEPTABLE CONDITION.

THIS INSTALLATION IS YET SECURE UP TO 25 PSF WIND UPLIFT PRESSURE.

REGARDING SNOW LIVE LOAD AND DEAD LOADING OF 538 LB RESULTANT LOAD PLACED ON RAFTER AT TWO POINTS, EXISTING SPAN OF 11'-11" IS ACCEPTABLE AT HOUSE WITH A 960 LB/SQ IN CALCULATED BENDING STRESS IS LESS THAN 1570 LB/SQ IN OF ALLOWABLE BENDING (FLEXURAL) STRESS – AN ACCEPTABLE CONDITION.

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P.O. Box 264•Farmville•VA 23901
(434) 574.6138; grichardpe@aol.com
www.optimizeces.com

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N.J..P.E. Lic. No. 29483

RAFTER STRESS CALCULATIONS FOR SHERRI DUNST, 151 WALTER ROAD, BRICK, NJ

July 27, 2011

DERIVATION EQUATION FOR WIND UPLIFT LOAD

BASIC WIND SPEED:	115 MPH
ROOF ZONE:	I
TOPOGRAPHIC FACTOR (KzL):	1.0
EXPOSURE CATEGORY:	B
WIND DIRECTIONALITY FACTOR:	0.85
GUST FACTOR (G):	1.51 @ 30' ABOVE GRADE
NET PRESSURE COEFFICIENT (UPLIFT, Cu):	-0.9
NET PRESSURE COEFFICIENT (DOWN, Cd):	1.28
IMPORTANCE FACTOR:	1.0
VELOCITY PRESSURE EXPOSURE COEFFICIENT:	0.5 @ 30' ABOVE GRADE

VELOCITY PRESSURE DUE TO WIND (qh)=0.00256 Kz Kzl Kd I V**2

AT 115 MPH: 0.00256(0.5)(1)(0.85)(1)(115)**2 = 14.38

WLu = qh g Cu = 14.18(1.51)(-0.9) = - 19.6 PSF

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N.J..P.E. Lic. No. 29483

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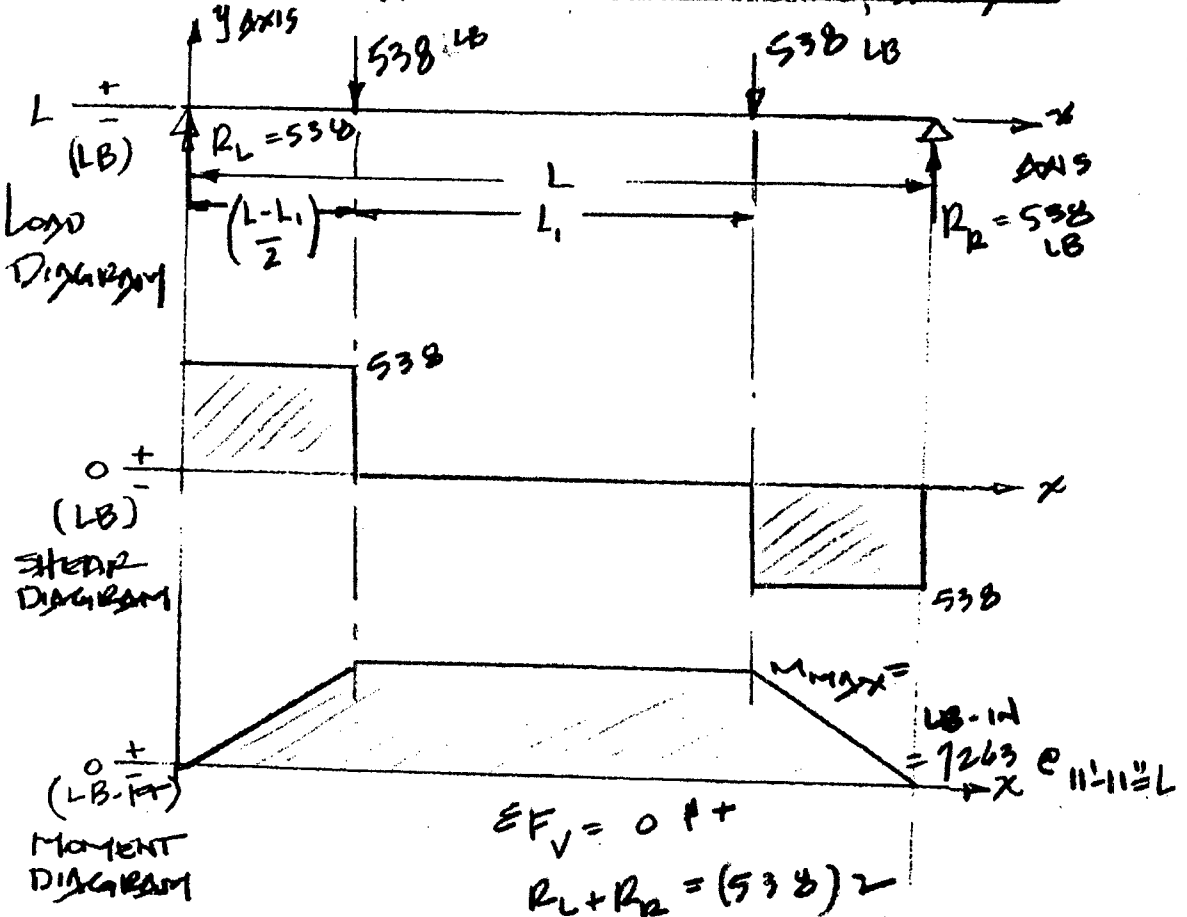
Consulting Engineering Services
P. O. Box 264
Farmville, VA 23901

SITE ADDRESS: SHERRI DUNST 151 WALTER RD. BRICK, NJ



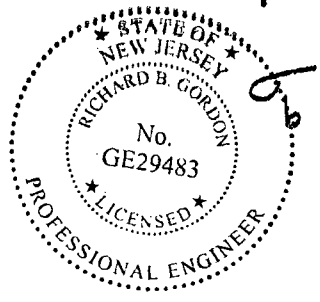
$\Sigma F_V = 0$ ↑ +

$R_L + R_R = (538)2$

DUE TO SYMMETRY, $R_L = R_R$

WITH DOUG FIR LARCH GRADE NO. 2,

875 LB/IN² = MAXIMUM PERMITTED FLEXURAL STRESS. WITH ADJUSTMENT FACTORS F_b = 875 psi BECOMES,



$F_b = (875 \frac{LB}{IN^2})(1.15)(1.3) = 1308 \frac{LB}{IN^2}$ ALLOWED.

1.15 = SIZE ADJUSTMENT FACTOR FOR REPETITIVE MEMBERS FACTOR

$(1308)(1.2) = 1570$ LB/IN²

1.2 = SNOW LOAD DURATION FACTOR

SHERRI DUNST, 151 WALTER RD.
BRICK, NJ

$$\sigma_b = \frac{M}{S} = \frac{M}{7.56\ IN^3}$$

FOR 2x6

AT L = 11'-11" SPAN, $L_1 = 116"$, $\frac{L - L_1}{2} = 13.5"$

$$\sigma_b = 7263\ LB\text{-}IN / 7.56\ IN^3 = 960\ \frac{LB}{IN^2}$$

1570 PSI > 960 PSI, AN ACCEPTABLE CONDITION.
ALLOW/60 LOAD

Optimize Engineering Co., LLC
Consulting Engineering Services
P. O. Box 264
Farmville, VA 23901

STATE OF NEW JERSEY
RICHARD B. GORDON
No. GE29483
LICENSED
PROFESSIONAL ENGINEER

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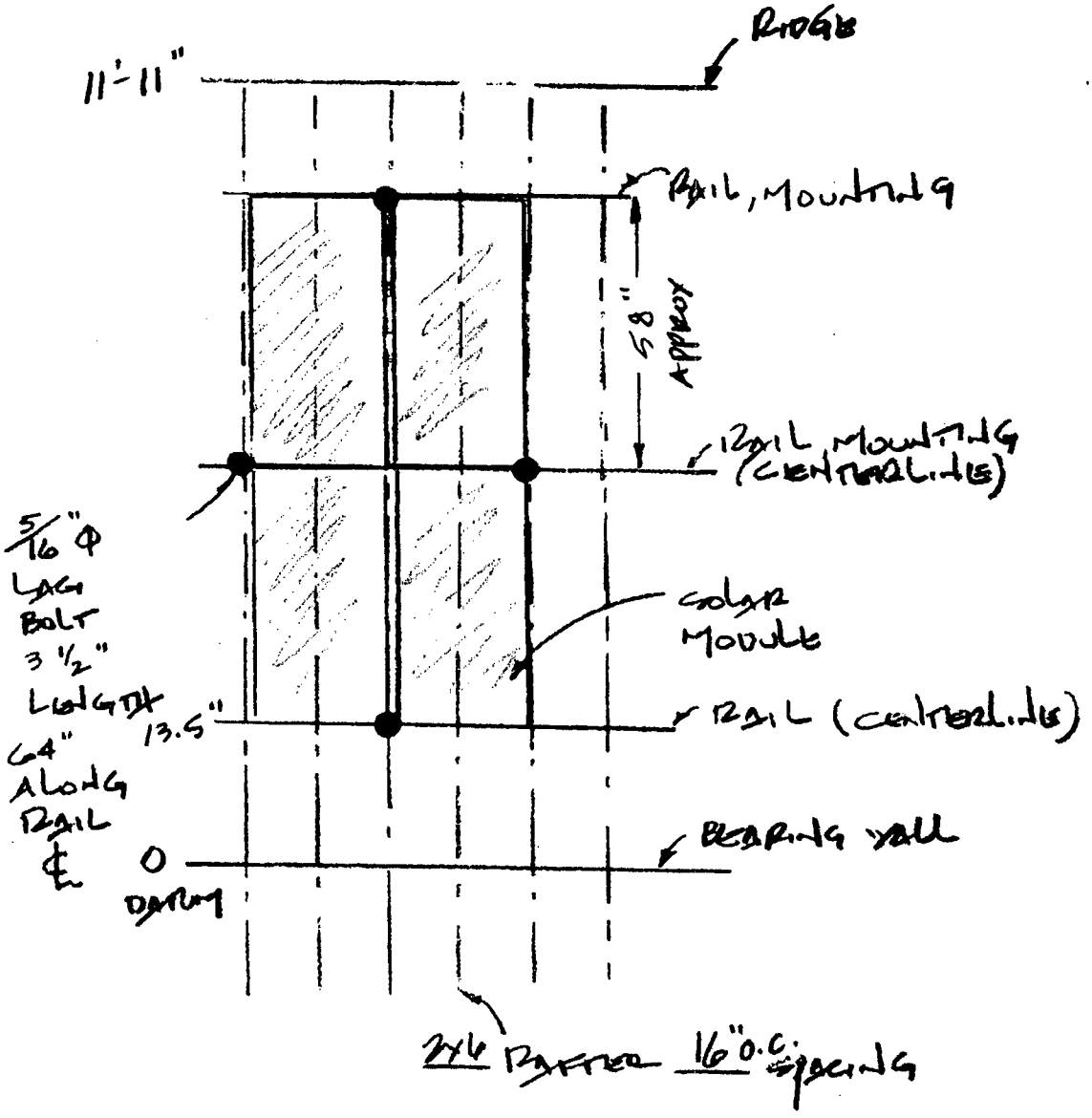
P. O. Box 264
Farmville, VA 23901

PROJECT SITE:
SHERRI DUNST
151 WALTER RD.
BRICK, NJ



REPRESENTATIVE AREA OF FOUR SOLAR MODULES - FASTENER (RAIL) LOCATIONS

STATE OF NEW JERSEY
RICHARD B. GORDON
No. GE29483
LICENSED
PROFESSIONAL ENGINEER

Brick Township
401 Chambersbridge Rd
Brick, NJ 08723
(732) 262-1027

Subcode Official Review

To: 151 WALTER RD BRICK, NJ 08724 CC:

RE: Building Subcode
Block: 1170.07 Lot: 6 Qual:
151 WALTER RD.
Permit Number: Control Number: C-11-002870
Last Submit Date: Wednesday, August 10, 2011

Date: Thursday, August 11, 2011

Dear DUNST, SHERRI,
Your request is hereby denied based upon the following infractions.

Engineer certification missing. Please be sure to have (both) roofs certified

Sincerely,

Michael Vecchio, Subcode Official

Trinity Solar
800 US Highway 9 South
Freehold, NJ 07728
(732) 780-3779

rec'd
8/25/11

Date: 8/23/11

To: Construction Department

From:

April Toots @ Trinity Solar

Attached is the revised engineer letter for customer:

Sherri Dunst-151 Walter Road

***** Please call our office at 732-414-3427 if you have further questions.**

Thank You,

April Toots

****
*** FAX TX REPORT ***
****

TRANSMISSION OK

JOB NO.	2041
DESTINATION ADDRESS	97327806671
PSWD/SUBADDRESS	
DESTINATION ID	
ST. TIME	08/17 12:52
USAGE T	00'17
PGS.	1
RESULT	OK

Brick Township
401 Chambersbridge Rd
Brick, NJ 08723
(732) 262-1027

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RAFTER STRESS CALCULATIONS FOR SHERRI DUNST, 151 WALTER ROAD, BRICK, NJ

July 27, 2011

TOTAL AREA OF 4 SOLAR MODULES FOR REPRESENTATIVE AREA LOADING

SOLAR MODULE AREA, TYP.	39.1" x 58.3"	=	15.83 SQ FT
TOTAL SOLAR MODULE AREA: FOR 4 MODULES	4 x 15.83 SQ FT	=	63.32 SQ FT
INTERMODULE SPACING:	0.5"		
TOTAL SPACING AREA:	0.5" x 58.3"	=	0.202 SQ FT
TOTAL PANEL AREA, TYPICAL:	63.32 + 0.404	=	63.724 SQ FT

MAX SOLAR PANEL LOADING DUE TO SNOW AND DEAD LOAD (MODULES & HARDWARE)

SNOW LIVE LOAD = (0.7)(30 PSF REFERENCE GROUND SNOW LOAD)		=	21 PSF
MODULES WEIGHT INCLUDING HARDWARE		=	4.33 PSF
MAX TOTAL LOAD:	25.33 PSF x 63.724 SQ FT	=	1614 LB

MAX LOADING PER SUPPORT (ATTACHMENT POINT) TO SNOW AND DEAD LOAD (MODULES & HARDWARE)

NUMBER OF SUPPORTS PER 4 MODULES = 4

LOAD PER SUPPORT:	1614 LB/4	=	538 LB

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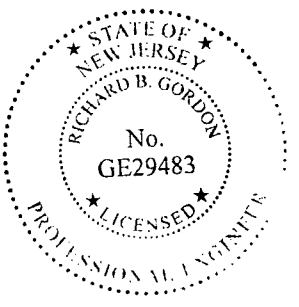

RAFTER STRESS CALCULATIONS FOR SHERRI DUNST, 151 WALTER ROAD, BRICK, NJ

July 27, 2011

MAX SOLAR PANEL LOADING DUE TO WIND UPLIFT LOADING

@ 115 MPH WIND LOAD, UPLIFT: 19.6 PSF (SEE DERIVATION EQUATION)

MAX TOTAL LOAD: 19.6 PSF x 63.724 SQ FT = 1249 LB

MAX LOADING PER SUPPORT DUE TO WIND UPLIFT LOADING

NUMBER OF SUPPORTS PER 4 MODULES = 4
LOAD PER SUPPORT: 1249 LB/4 = 312 LB

TYPICAL ROOF LUMBER

Species	Specific Gravity	Lag Screw Withdraw Capacity for 5/16" dia. lb/in of thread	Withdrawl Capacity for 2" Of Thread
Doug Fir Larch	0.5	266	532
Doug Fir Larch (North)	0.49	258	516
Doug Fir South	0.46	235	470
Engelmann Spruce Lodgepole Pine (MSR 1650 F & higher Grades)	0.46	235	470
Hem Fir	0.43	212	424
Hem Fir (North)	0.46	235	470
Southern Pine	0.55	307	614
Spruce Pine Fir	0.42	205	410

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RAFTER STRESS CALCULATIONS FOR SHERRI DUNST, 151 WALTER ROAD, BRICK, NJ

July 27, 2011

Spruce Pine Fir			
(E=2x10**6 psi			
& higher grades			
Of MSR and MEL)	0.5	266	532

(Source: National Design Specification for Wood Construction and Universal Building Code)

CONCLUSION

THE SOFTEST WOOD USED IN FRAMING IS SPRUCE PINE FIR.

THE WITHDRAW REQUIRED TO PULL OUT A 5/16" DIA LAG SCREW IS 410 LB.

WE HAVE CALCULATED 312 LB POSSIBLE UNDER LOAD WHEN SUBJECTED TO AN UPLIFT FORCE OF 19.6 PSF.

THIS PROVIDES A 31.4 % SAFETY MARGIN OR A FACTOR OF SAFETY OF 410/312 = 1.314 FOR EXPOSURE CATEGORY B AND IS AN ACCEPTABLE CONDITION.

THIS INSTALLATION IS YET SECURE UP TO 25 PSF WIND UPLIFT PRESSURE.

REGARDING SNOW LIVE LOAD AND DEAD LOADING OF 538 LB RESULTANT LOAD PLACED ON RAFTER AT TWO POINTS, EXISTING SPAN OF 11'-11" IS ACCEPTABLE AT HOUSE WITH A 960 LB/SQ IN CALCULATED BENDING STRESS IS LESS THAN 1570 LB/SQ IN OF ALLOWABLE BENDING (FLEXURAL) STRESS – AN ACCEPTABLE CONDITION.

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RAFTER STRESS CALCULATIONS FOR SHERRI DUNST, 151 WALTER ROAD, BRICK, NJ

July 27, 2011

DERIVATION EQUATION FOR WIND UPLIFT LOAD

BASIC WIND SPEED:	115 MPH
ROOF ZONE:	I
TOPOGRAPHIC FACTOR (KzL):	1.0
EXPOSURE CATEGORY:	B
WIND DIRECTIONALITY FACTOR:	0.85
GUST FACTOR (G):	1.51 @ 30' ABOVE GRADE
NET PRESSURE COEFFICIENT (UPLIFT, Cu):	-0.9
NET PRESSURE COEFFICIENT (DOWN, Cd):	1.28
IMPORTANCE FACTOR:	1.0
VELOCITY PRESSURE EXPOSURE COEFFICIENT:	0.5 @ 30' ABOVE GRADE

VELOCITY PRESSURE DUE TO WIND (qh)=0.00256 Kz Kzl Kd I V**2

AT 115 MPH: 0.00256(0.5)(1)(0.85)(1)(115)**2 = 14.38

WLu = qh g Cu = 14.18(1.51)(-0.9) = - 19.6 PSF

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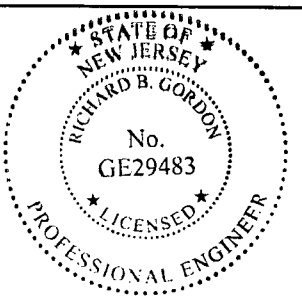

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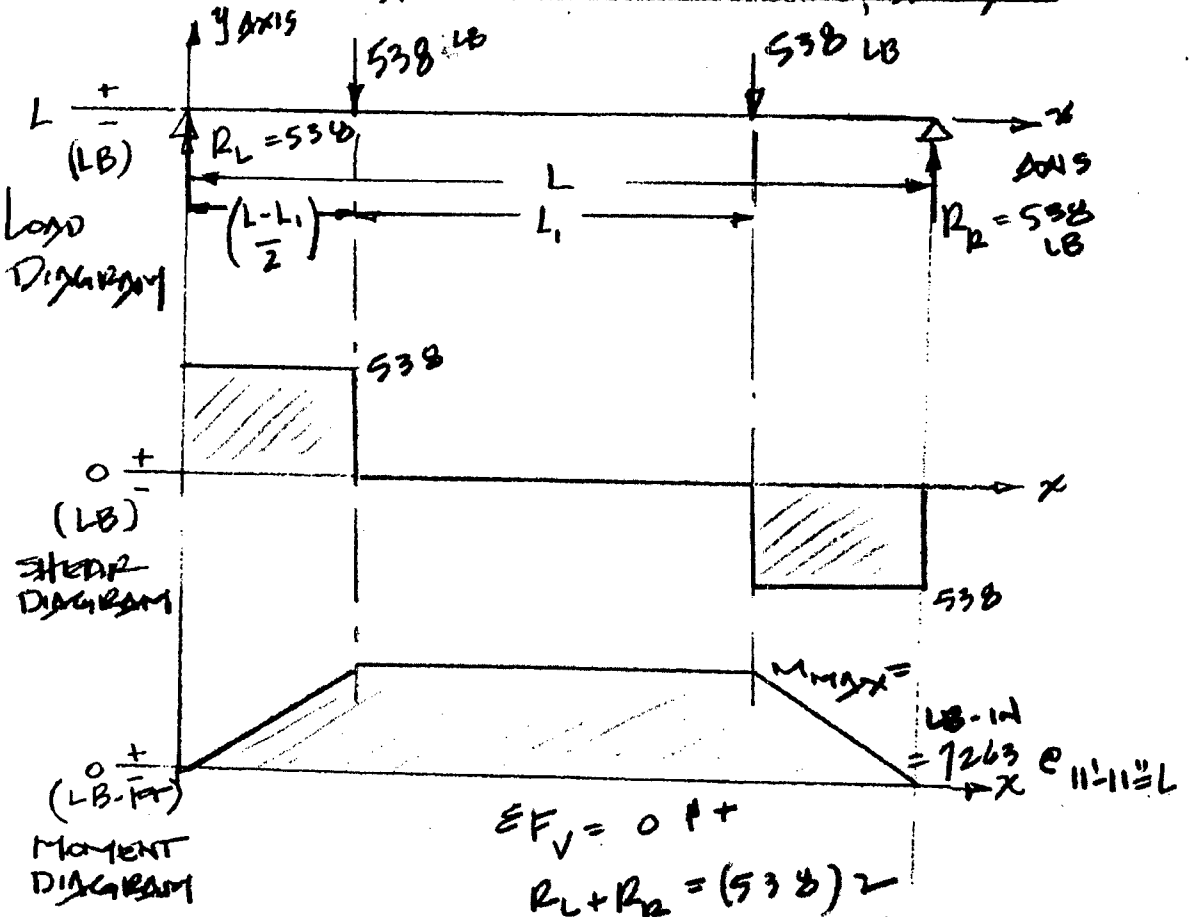
SITE ADDRESS: SHERRI DUNST 151 WALTER RD. BRICK, NJ



$\Sigma F_V = 0$ + +

$R_L + R_R = (538)2$

DUE TO SYMMETRY, $R_L = R_R$

WITH DOUG FIR LARCH GRADE NO. 2,

875 LB/IN² = MAXIMUM PERMITTED FLEXURAL STRESS. WITH ADJUSTMENT FACTORS F_b = 875 psi BECOMES,

$F'_b = (875 \frac{LB}{IN^2})(1.15)(1.3) = 1308 \ LB/IN^2$ ALLOWED.

1.15 = SIZE ADJUSTMENT FACTOR

1.3 = FOR REPETITIVE MEMBERS FACTOR

$(1308)(1.2) = 1570 \ LB/IN^2$

1.2 = SNOW LOAD DURATION FACTOR

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SHERRI DUNST, 151 WALTER RD. PAGE 6 OF 7
BRICK, NJ

$$\sigma_b = \frac{M}{S} = \frac{M}{7.56\ IN^3}$$
FOR 2×6

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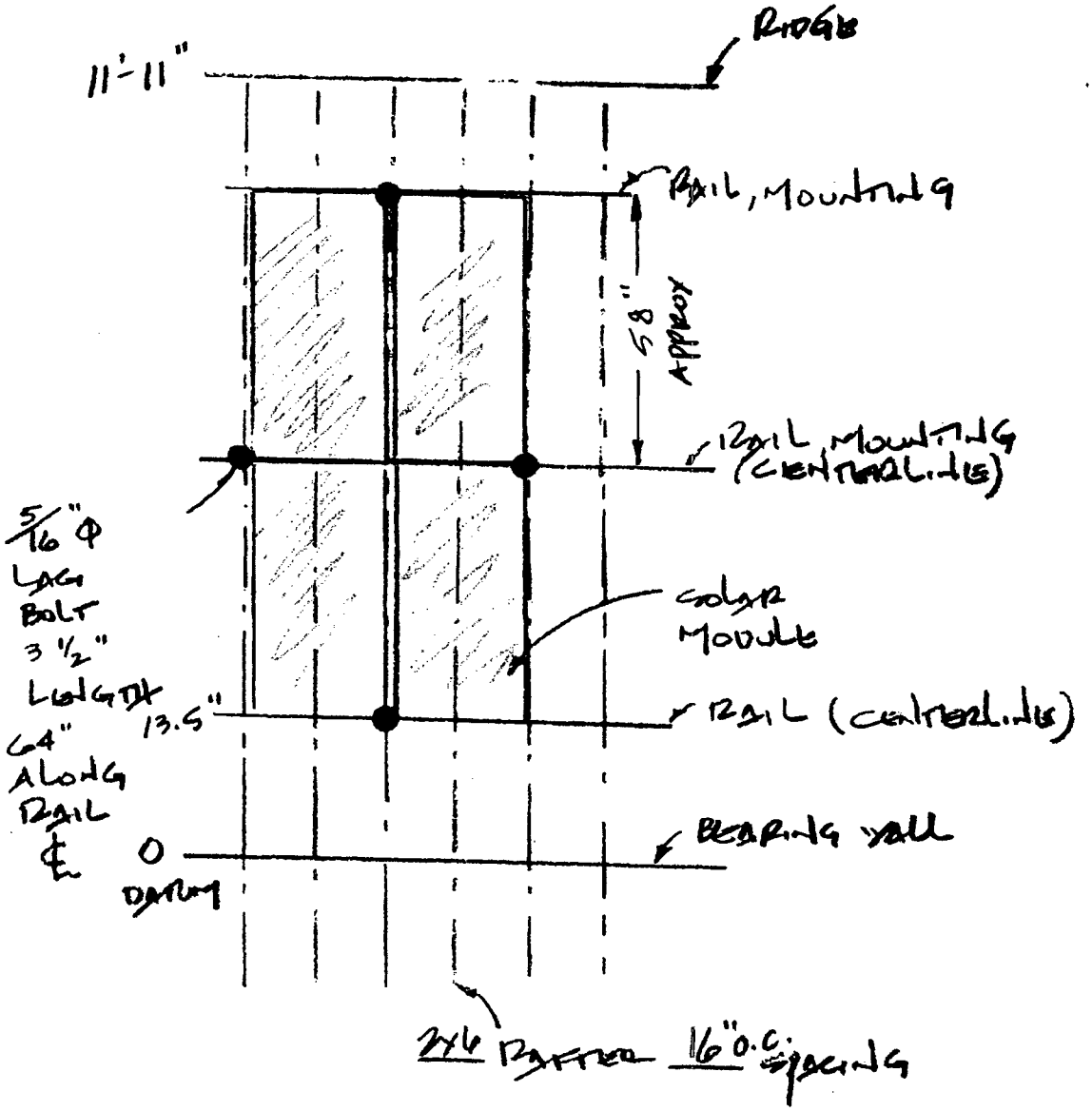

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