

BLOCK 835 LOT 37 QUALIFICATION CODE _____ ADDRESS (SITE) _____ PERMIT NO. 11-2966



CONSTRUCTION PERMIT APPLICATION

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

C-11-113307

V. FEE SUMMARY (for office use only)

		Update	Update
1. Building	\$ <u>200</u>		
2. Electrical	\$ <u>2445</u>		
3. Plumbing			
4. Fire Protection			
5. Elevator Devices			
6. Subtotal			
7. Less 20% for State Plan Review	\$		
8. Subtotal	\$		
9. State Permit Surcharge Fee	\$ <u>173</u>		
10. Subtotal	\$		
11. Cert. of Occupancy			
12. Other			
13. TOTAL	\$ <u>2618</u>		

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

I. IDENTIFICATION

1. Proposed Work Site at: 1669 Rt. 88 Brick

2. Name of Owner in Fee: Gangi Graphics

Tel. () e-mail

Address 1669 Rt. 88

3. Ownership in Fee: Public Private municipality zip code

4. Principal Contractor: Whitman Construction Tel. 732, 245-0875

Address 2511 Lakewood rd, e-mail pt.pleasant NJ 08742

License No. OR, if new home, Builder Reg. No. 13V40063100 Exp. Date 12/31/11

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

Federal Emp. ID No. FAX: ()

5. Architect or Engineer

Address Contact e-mail

Tel. () FAX: ()

6. Responsible Person in Charge once Work has Begun

Tel. () FAX: ()

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)

- ☒ Building
- ☐ Electrical
- ☐ Plumbing
- ☐ Fire Protection
- ☐ Elevator

FOR OFFICE USE ONLY (Optional)

Est. Cost	Plans Rec'd by	Date Rec'd	Rejection Date	Approval Date	Re-viewer	Resubmission Dates	Re-viewer
<u>95,000.00</u>	<u>9/7/11</u>	<u>9/20/11</u>	<u>9/28/11</u>	<u>9/28/11</u>	<u>JS</u>		
<u>EN6</u>	<u>9/15/11</u>	<u>EXEMPT</u>	<u>9/16/11</u>	<u>ND</u>			

TOTAL COST 95,000.00

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 Whitman Construction LLC

Address 2511 Lakewood Rd.

pt. Pleasant NJ 08742

Telephone (732) 295-0875

Signature Melanie Whitman

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

OFFICE DATE RECEIVED: 9-13-11 JK 20

VIII. PRIOR APPROVALS CHECKLIST (office use only)	LOCAL APPROVAL		COUNTY APPROVAL		REGIONAL APPROVAL		STATE APPROVAL		COMMENTS
	Prelimin. Initial	Final Date	Prelimin. Initial	Final Date	Prelimin. Initial	Final Date	Prelimin. Initial	Final Date	
☒ Zoning Officer	JK	9/13/11							2A-11-00969
☐ Planning Board									
☐ Zoning Board									
☐ Sewer Authority									
☐ Water Authority									
☐ Police Department									
☐ Health Department									
☐ Soil Conservation									
☐ N.J. Department of Community Affairs									
☐ N.J. Department of Transportation									
☐ N.J. Department of Environmental Protection									
☐ Utility Dig No.									
☐									
☐									

IX. SUBCODES AND SPECIAL REGULATIONS APPLICABLE (office use only—optional)	
Name of Code & Edition	Name of Code & Edition
Building	Energy
Electrical	Barrier Free
Plumbing	Flood Hazard
Fire Protection	As Built Elevation Cert.
Mechanical	Other

X. CERTIFICATES ISSUED (office use only)	
DATE ISSUED	DATE EXPIRED
☐ Temporary Certificate of Occupancy	No. _____
☐ Temporary Certificate of Compliance	No. _____
☐ Continued Certificate of Occupancy	No. _____
☐ Certificate of Compliance	No. _____
☐ Certificate of Occupancy	No. _____
☐ Certificate of Approval	No. _____
☐ Lead Abatement Clearance Certificate	No. _____



Brick Township
401 Chambersbridge Rd
Brick, NJ 08723

Date Issued 11/03/2011
Control Number C-11-003307
Permit Number 11-2966
Permit Issue Date 10/03/2011
Certificate Number 11-2966

Certificate

Construction Code Division
(Certificate of Approval)

Identification

Work Site Location: 1669 ROUTE 88 Gangi Graphics Brick Township, NJ Block: 835 Lot: 37 Qual: _____
Owner in Fee: 1669 ROUTE 88 WEST LLC
Owner Address: 1669 ROUTE 88 BRICK NJ 08724
Telephone: _____
Contractor WHITMAN CONSTRUCTION
Address 2511 LAKEWOOD ROAD PT. PLEASANT NJ 08742-
Telephone: 732/2950875 Fax: _____
License Number or Builders Registration Number: 13VH00613100 Federal Emp. Number: 22-3558985

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:

Daniel Newman Jr.

Construction Official

Fee: \$0.00
Check Number: _____
Collected By: _____



CONSTRUCTION PERMIT

Date Issued
Control #
Permit #

10/3/11
C-11-003307
11-2466

IDENTIFICATION Block: 835 Lot: 37 Qualifier
Work Site Location: 1669 ROUTE 88 Gangi Graphics Brick Township, NJ Contractor WHITMAN CONSTRUCTION
Owner in Fee 1669 ROUTE 88 WEST LLC Address 2511 LAKEWOOD ROAD PT. PLEASANT NJ 08742-
1669 ROUTE 88 BRICK NJ 08724 Telephone: 732/2950875
Telephone: Lic. No. or Bldrs. Reg. No. 13VH00613100
Federal Employee. No. 22-3558985

Is hereby granted permission to perform the following work:

- ☒ BUILDING ☐ PLUMBING ☐ LEAD HAZARD ABATEMENT
☒ ELECTRICAL ☐ FIRE PROTECTION ☐ DEMOLITION
☐ ELEVATOR DEVICES ☐ ASBESTOS ABATEMENT (Subchapter 8 only) ☐ OTHER

DESCRIPTION OF WORK:

SOLAR PANELS

Note: If construction 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 \$101,500

[Signature]
Construction Official

9-30-11
Date

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

1 WHITE - INSPECTOR

2 CANARY - OFFICE

3 PINK - TAX ASSESSOR

4 GOLD - APPLICANT

PAYMENTS (Office Use Only)

Building	\$2,445
Electrical	\$200
Plumbing	\$0
Fire Protection	\$0
Elevator Devices	\$0
Other	\$0.00
DCA Training Fee	\$173
CO Fee	
Other	\$0
Total	\$2,818
Check No.	10177
Cash	\$0
Credit	\$0
Collected By	

150
28.8

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:

- 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.
- Foundations and all walls up to grade level prior to back filling.
- 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.
- Installation of all finished materials, sealings of exterior joints, plumbing piping, trim and fixtures; electrical wiring, devices and fixtures; mechanical systems equipment.

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.

- ☒ 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 must be scheduled at the same time
a final electric inspection is necessary

- ☒ 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".

- ☒ A complete copy of released plans must be kept on the job site.

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

Community Development and Land Use

401 Chambers Bridge Rd.

Brick NJ 08723

(732) 262-1027



Receipt

Payment Date 10/03/2011

Transaction # PMT-11-06558

Receipt #

Issued To WHITMAN CONST

Description SOLAR PANELS
1669 ROUTE 88

Date Printed 10/03/2011

Check Number 10177

Cash \$0.00

Check \$50.00

Charge \$0.00

Total Paid \$50.00

10/03/11 1:26PM 001558#9547
XX01 SERV.001

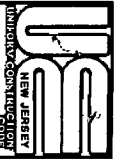
#06558

ZPA

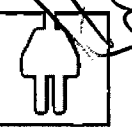
CHECK

\$50.00

\$50.00



ELECTRICAL SUBCODE TECHNICAL SECTION



Change of Contractor

Per # 11-2966+

update 10/13/2011

Date Received
Control #
Date Issued
Permit #

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

Block 835 Lot 37 Qualification Code _____
Work Site Location 1669 Rt 88 Brick

Owner in Fee: Gary Graphics

Tel. (732) 298-0875 e-mail _____

Address 1669 Rt 88 Brick Municipality _____ Zip code _____

Contractor: Garden State Electric Tel. (732) 223-8600
Address 208 E. Main Street e-mail dpv@elcomsn.com
Manasquan NJ 08736 (908) 223-8600

Contractor License No. 6720 Exp. Date 03/12

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

Federal Emp. ID No. 22293724 FAX: (732) 223-8288

B. ELECTRICAL CHARACTERISTICS

Use Group Present _____ Proposed _____

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

Building Occupied as Business Utility Co. _____

Est. Cost of Elec. Work \$ 4,423.00

JOB SUMMARY (Office Use Only)

PLAN REVIEW	INSPECTIONS	Dates (Month/Day)
[] No Plans Required	Type: _____	Failure Failure Approval Initial
[] Partial -Under-slab Utilities Approved	Rough	
Date: _____ Approved by: _____	Barrier-Free	
[] Electric Plans Approved	Trench	
Date: _____ Approved by: _____	Temp. Serv.	
[] Electric Plans Approved	Constr. Serv.	
Date: _____ Approved by: _____	TCO	
Joint Plan Review Required:	Other	
[] Bldg. [] Plumb. [] Fire. [] Elev.	Service	
SUBCODE APPROVAL for PERMIT	Final	
Date: _____	Barrier-Free	
Approved by: _____	Temp. Cut-in-Card Date Issued	
SUBCODE APPROVAL for CERTIFICATE	Final Cut-in-Card Date Issued	
[] CO [] CCO [] CA	Annual Pool Inspection	
Date: <u>11-3-11</u>	Date of Grounding and Bonding	
Approved by: <u>JS</u>	Certification	

U.C.C. F.120 (rev. 11/09)

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: [Signature]

Print name here: Daniel Ludwig

[] Licensed Elec. Contractor [] Certif'd Landscape Irrigation Contr [] Exempt Applicant

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK: 22kw Solar System.

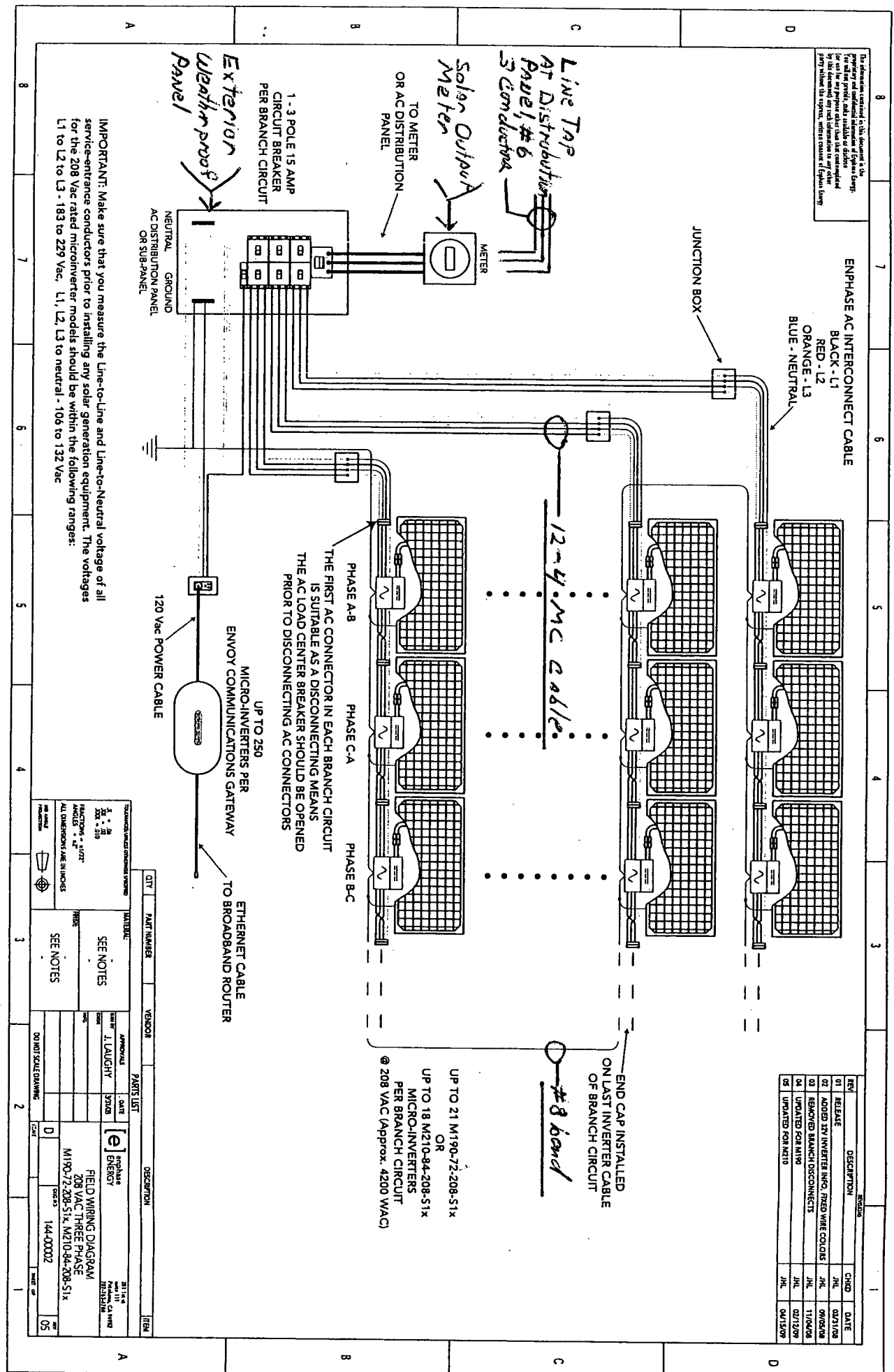
QTY.	SIZE	ITEMS	FEE (Office Use Only)
		Lighting Fixtures	
		Receptacles	
		Switches	
		Detectors	
		Light Poles	
		Motors - Fract. HP	
		Emergency & Exit Lights	
		Communications Points	
		Alarm Devices/F.A.C. Panel	
		<u>Solar Panels</u>	
		TOTAL NUMBERS	
		Pool Permit/with UW Lights	
		Storable Pool/Spa/Hot 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 1/4 HP	
		KW Transformer/Generator	
		AMP Service	
		AMP Subpanels / <u>Solar</u>	
		AMP Motor Control Center	
		KW Elec. Sign/Outline Light	
		<u>5 20amp Solar Circuits</u>	

To reorder call: ALL EGRA
Marketing • Print • Mail
(609) 390-1400

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

Job Gangi Graphs 732-295-0875
1669 Rt 88 Brid

10/13/2004
UPDATE
w/changes
from original

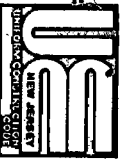


REV	DESCRIPTION	CHG	DATE
01	RELEASE	JHL	02/17/08
02	ADDED 2ND INVERTER INFO, REDD WIRE COLOR	JHL	09/26/08
03	REMOVED BRANCH DISCONNECTS	JHL	11/06/08
04	UPDATED FOR M190	JHL	02/12/09
05	UPDATED FOR M210	JHL	04/15/09

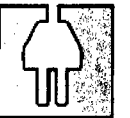
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1	190-72-208-51x		FIELD WIRING DIAGRAM 208 VAC THREE PHASE M190-72-208-51x, M210-44-208-51x	05
1	144-00002		FIELD WIRING DIAGRAM 208 VAC THREE PHASE M190-72-208-51x, M210-44-208-51x	05

QTY	PART NUMBER	VENUE	DESCRIPTION	ITEM
1	190-72-208-51x		FIELD WIRING DIAGRAM 208 VAC THREE PHASE M190-72-208-51x, M210-44-208-51x	05
1	144-00002		FIELD WIRING DIAGRAM 208 VAC THREE PHASE M190-72-208-51x, M210-44-208-51x	05

QTY	PART NUMBER	VENUE	DESCRIPTION	ITEM
1	190-72-208-51x		FIELD WIRING DIAGRAM 208 VAC THREE PHASE M190-72-208-51x, M210-44-208-51x	05
1	144-00002		FIELD WIRING DIAGRAM 208 VAC THREE PHASE M190-72-208-51x, M210-44-208-51x	05



ELECTRICAL SUBCODE TECHNICAL SECTION



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

Block 835 Lot 31 Qualification Code _____
Work Site Location 1669 Rt-88

Owner In Fee Gauss Graphics
Address 1669 Rt-88

Tel (732) 295 0875
Contractor Hollis Electric
Address 41 Bay Bldg - 0

Tel (732) 273-5272 FAX (732) 295-4662
Contractor License No. 15655
Federal Emp. No. 140846408

B. ELECTRICAL CHARACTERISTICS

Use Group _____ Present _____ Proposed _____
☐ Pole/Pad # _____ ☐ Temporary ☐ Other _____
Building Occupied as _____ Utility Co. _____
Est. Cost of Elec. Work \$ 6,500

JOB SUMMARY (Office Use Only)

PLAN REVIEW	Date	Initial	INSPECTIONS	Dates (Month/Day)
☐ No Plans Required			Type:	Failure Failure Approval Initial
Joint Plan Review Required:			Rough	<u>2-10-12-11</u>
☐ Building ☐ Plumbing			Barrier-Free	
☐ Fire ☐ Elevator			Trench	
☒ Elec. Plans Approved			Temp. Serv.	
Date: <u>7/29/11</u>			Const. Serv.	
Approved by: <u>[Signature]</u>			TCO	
			Other	
			Service	
			Final	
			Barrier-Free	
SUBCODE APPROVAL			Temp. Cut-in-Card Date Issued	
☐ CO ☐ CCO ☐ CA			Final Cut-in-Card Date Issued	
Date: <u>11-3-11</u>			Annual Pool Inspection	
Approved by: <u>[Signature]</u>			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's Signature/Contractor's Seal and Signature

[] Licensed Elec. Contractor [] Certified Landscape Irrigation Contr [] Exempt Applicant

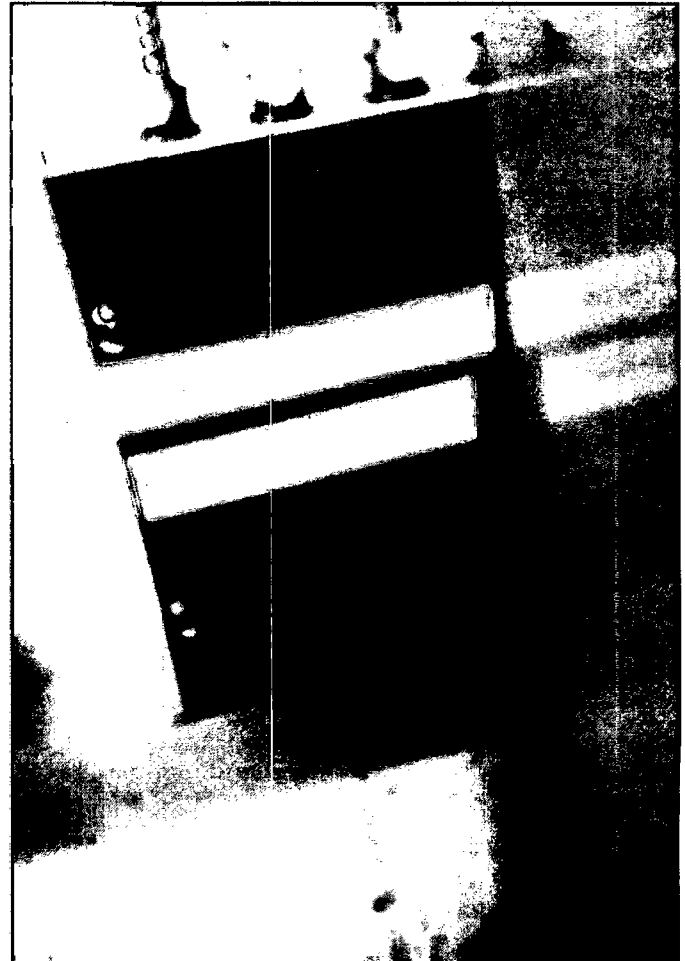
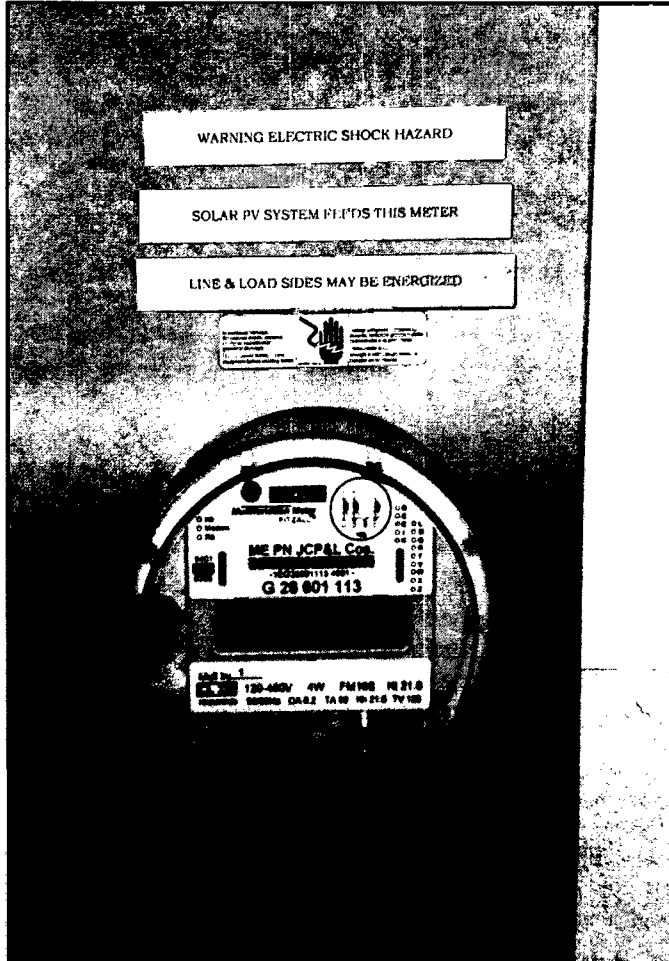
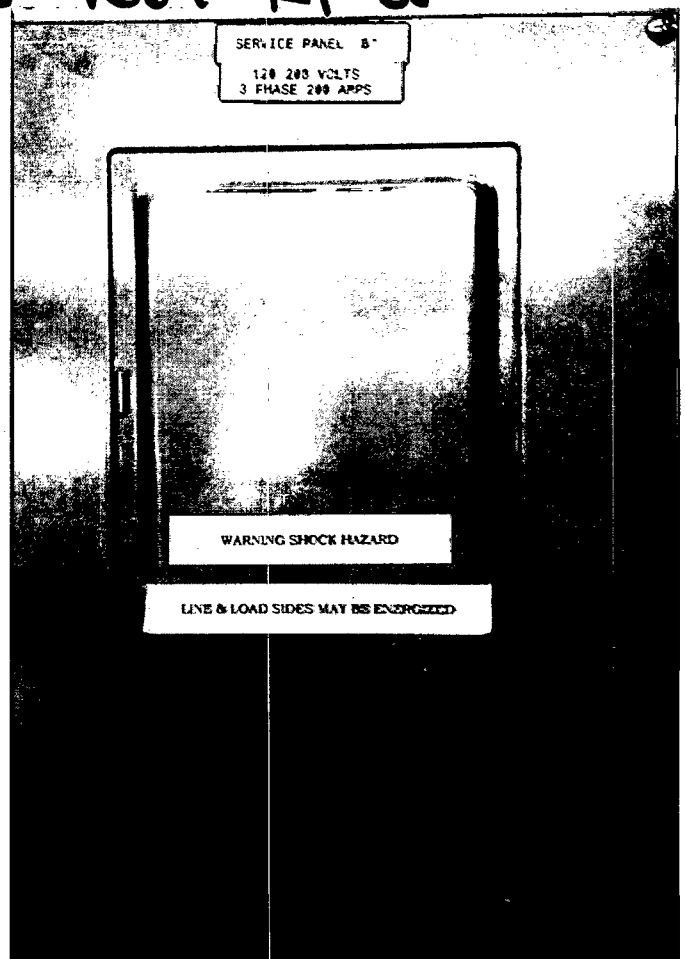
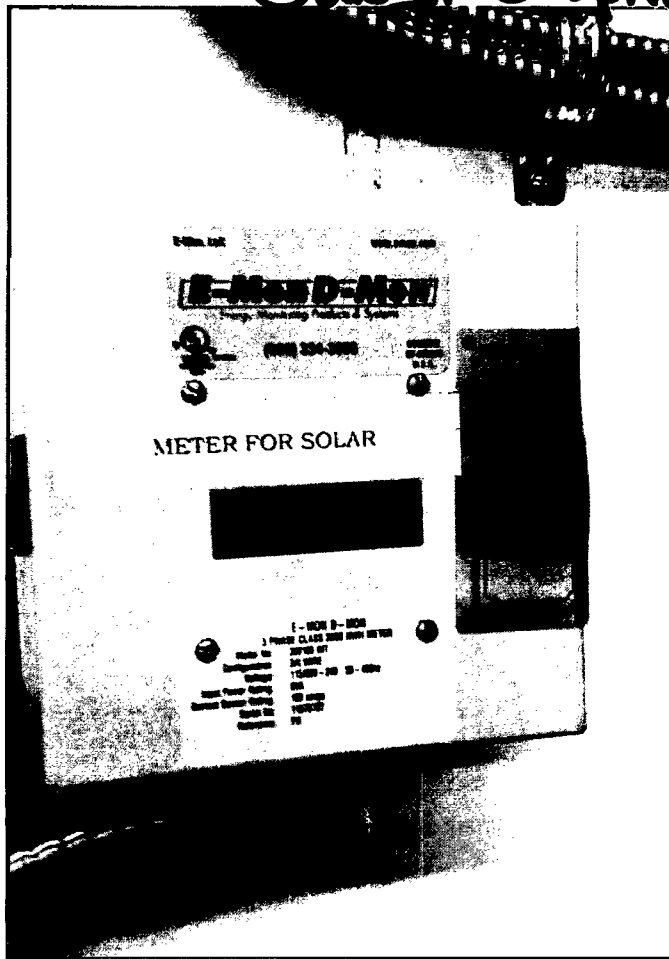
D. TECHNICAL SITE DATA

QTY.	SIZE	ITEMS
		Lighting Fixtures
		Receptacles
		Switches
		Detectors
		Light Poles
		Molded Fract. HP
		Emergency & Exit Lights
		Communications Points
		Alarm Devices/F.A.C. Panel

TOTAL NUMBERS

Pool Permit/with UV 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 1/4 HP	
KW Transformer/Generator	
AMP Service	
AMP Subpanels	
AMP Motor Control Center/Disconnector	
KW Elec. Sign/Outline Light	
Other Panels	
Micro Inverters	

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





BUILDING SUBCODE TECHNICAL SECTION



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

Block 835 Lot 37 Qualification Code _____
Work Site Location 1669 Rt. 88 Brick

Owner in Fee: Lang's Graphics

Tel: (_____) _____ e-mail _____
Address 1669 Rt. 88 Brick zip code _____

Contractor: Whitman Construction LLC 732-295-0875
Address 2511 Lawrencewood rd. e-mail _____

Contractor License No. or Builder Registration No. 13W70663100 Exp. Date 12/31/11
Home Improvement Contractor Registration No. or Exemption Reason (if applicable): _____

Federal Emp. ID No. _____ FAX: (_____) _____

JOB SUMMARY (Office Use Only)

PLAN REVIEW	Date	Initial	INSPECTIONS	Dates (Month/Day)
				Failure Failure Approval Initial
☒ All Plans Required	<u>9/20/11</u>	<u>W</u>	Footings	
☒ Footings/Foundations			Footings Bonding	
☐ Structural/Framework			Foundation	
☐ Exterior			Slab	
☐ Interior			Frame	
Joint Plan Review Required:			Truss Sys./Bracing	
☐ Elec. ☐ Plumb. ☐ Fire ☐ Elevator			Barrier-Free	
SUBCODE APPROVAL for PERMIT	<u>9/29/11</u>	<u>W</u>	Insulation	
Date: _____			Finishes -Base Layer	
Approved by: _____			Finishes -Final	
SUBCODE APPROVAL for CERTIFICATE	<u>10/12/11</u>	<u>W</u>	Energy	
Date: <u>10/12/11</u> <u>W</u> CA			Mechanical	
Approved by: _____			TCO	
			Other	
			Final	<u>10/19/11</u> <u>W</u>
			Barrier-Free	

B. BUILDING CHARACTERISTICS

Use Group	Present	Proposed	Constr. Class	Present	Proposed
No. of Stories			If Industrialized Building:		
Height of Structure			State Approved		HUD
Area — Largest Floor			Est. Cost of Bldg. Work:		
New Bldg. Area/All Floors			1. New Bldg.	\$	
Volume of New Structure			2. Rehabilitation	\$	
Max. Live Load			3. Total (1+2)	\$	<u>95,000.00</u>
Max. Occupancy Load					

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:

Melanie Whitman

Print name here:

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK

Roofing- Installation of Solar panels

TYPE OF WORK:

- ☐ New Building
- ☐ Addition
- ☐ Rehabilitation
- ☒ Roofing
- ☐ Siding
- ☐ Fence _____ Height (exceeds 6') _____ Sq. Ft.
- ☐ Sign _____ Sq. Ft.
- ☐ Pool
- ☐ Retaining Wall _____ Sq. Ft.
- ☐ Asbestos Abatement Subchapter 8
- ☐ Lead Haz. Abatement NJAC 5:17
- ☐ Radon Remediation
- ☐ Other Solar panels
- ☐ Demolition

FEE (Office Use Only)

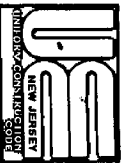
Administrative Surcharge \$	
Minimum Fee \$	
State Permit Surcharge Fee \$	
TOTAL FEE \$	

Date Received 10/3/11
Control # 11-2966
Date Issued _____
Permit # _____

No Plans

1 White = Inspector Copy
3 Pink = Office Copy

2 Canary = Office Copy
4 Gold = Applicant Copy



ELECTRICAL SUBCODE TECHNICAL SECTION



Change of Contractor, Gully

Per # 11-2966+

update 10/13/2011

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

Block 835 Lot 37 Qualification Code _____

Work Site Location 1665 Rt 88 Brick

Owner in Fee: Gaul's Graphics

Tel. (732) 295-0875 e-mail _____

Address 1665 Rt 88 Brick

Contractor: Garden State Electric Tel. (732) 223-8288 e-mail dpyle@gsen.com

Address Manasquan NJ 08736

Contractor License No. 6720 Exp. Date 03/12

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

Federal Emp. ID No. 22293724 FAX: (732) 223-8288

B. ELECTRICAL CHARACTERISTICS

Use Group Present _____ Proposed _____

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

Building Occupied as Business Utility Co. _____

Est. Cost of Elec. Work \$ 4423.00

JOB SUMMARY (Office Use Only)

PLAN REVIEW		INSPECTIONS		Dates (Month/Day)	
	Type:	Failure	Failure	Approval	Initial
[] No Plans Required					
[] Partial - Under-slab Utilities Approved	Rough				
Date: _____	Barrier-Free				
[] Electric Plans Approved	Trench				
Date: _____	Temp. Serv.				
Approved by: _____	Const. Serv.				
Joint Plan Review Required:	TCO				
[] Bldg. [] Plumb. [] Fire. [] Elev.	Other				
SUBCODE APPROVAL for PERMIT	Service				
Date: _____	Final				
Approved by: _____	Barrier-Free				
SUBCODE APPROVAL for CERTIFICATE	Temp. Cut-in-Card Date Issued				
[] CO [] CCO [] CA	Final Cut-in-Card Date Issued				
Date: _____	Annual Pool Inspection				
Approved by: _____	Date of Grounding and Bonding Certification				

U.C.C. F120 (rev 11/09)

C. CERTIFICATION IN LIEU OF OATH

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

Applicant's Sign/Contractor sign and seal here: Daniel Ludwig

Print name here: Daniel Ludwig

DESCRIPTION OF WORK: 22kw solar system.

QTY. SIZE ITEMS

Lighting Fixtures

Receptacles

Switches

Detectors

Light Poles

Motors - Fract. HP

Emergency & Exit Lights

Communications Points

Alarm Devices/F.A.C. Panel

Solar Panels

TOTAL NUMBERS

Pool Permit/with UV Lights

Storage 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 1/4 HP

KW Transformer/Generator

AMP Service

AMP Subpanels 1 Solar

AMP Motor Control Center

KW Elec. Sign/Outline Light

5 20amp Solar Circuits

Administrative Surcharge \$

Minimum Fee \$

State Permit Surcharge Fee \$

TOTAL FEE \$

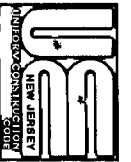
To reorder call: ALLEGRA

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(609) 390-1400

Date Received
Control #
Date Issued
Permit #

11-2966+



ELECTRICAL SUBCODE TECHNICAL SECTION



Change of Contractor, Gully

Per # 11-2966+

update 12/13/2011

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

Block 835 Lot 37 Qualification Code _____

Work Site Location 1669 Rt 88 Buick

Owner in Fee: Gary Gophers

Tel. (732) 295-0875 e-mail _____

Address 1669 Rt 88 Buick

Contractor: Garden State Electric Tel. (732) 283-0000

Address 208 E Main St e-mail dg@electric.com

Manasquan NJ 08736

Contractor License No. 6720 Exp. Date 2-1-12

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

Federal Emp. ID No. 22243724 FAX: (732) 223-8258

B. ELECTRICAL CHARACTERISTICS

Use Group Present _____ Proposed _____

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

Building Occupied as Business Utility Co. _____

Est. Cost of Elec. Work \$ 4,423.00

JOB SUMMARY (Office Use Only)

PLAN REVIEW		INSPECTIONS		Dates (Month/Day)	
	Type:	Failure	Failure	Approval	Initial
[] No Plans Required	Rough				
[] Partial - Underslab Utilities Approved	Barrier-Free				
Date: _____	Trench				
[] Electric Plans Approved	Temp. Serv.				
Date: _____	Const. Serv.				
Joint Plan Review Required:	TCO				
[] Bldg. [] Plumb. [] Fire. [] Elev.	Other				
SUBCODE APPROVAL for PERMIT	Service				
Date: _____	Final				
Barrier-Free					
Approved by: _____	Temp. Cut-in-Card Date Issued				
SUBCODE APPROVAL for CERTIFICATE	Final Cut-in-Card Date Issued				
[] CO [] CCO [] CA	Annual Pool Inspection				
Date: _____	Date of Grounding and Bonding				
Approved by: _____	Certification				

U.C.C. F120 (rev 11/09)

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

Print name here: Daniel L. Lanning

[X] Licensed Elec. Contractor [] Certif'd Landscape Irrigation Contr [] Exempt Applicant

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK: 22kw Solar System

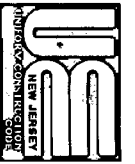
QTY.	SIZE	ITEMS	FEE (Office Use Only)
		Lighting Fixtures	
		Receptacles	
		Switches	
		Detectors	
		Light Poles	
		Motors - Fract. HP	
		Emergency & Exit Lights	
		Communications Points	
		Alarm Devices/F.A.C. Panel	
		<u>Solar Rack</u>	
		TOTAL NUMBERS	
		Pool Permit/with UV Lights	
		Storable Pool/Spa/Hot 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 1/4 HP	
		KW Transformer/Generator	
		AMP Service	
		AMP Subpanels /Solar	
		AMP Motor Control Center	
		KW Elec. Sign/Outline Light	
		<u>20amp Solar Circuits</u>	

Date Received
Control #
Date Issued
Permit #

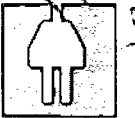
11-2966+

To render call: ALLEGRA
Marketing - Print - Mail
(609) 390-1400

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



ELECTRICAL SUBCODE TECHNICAL SECTION



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

Block 285 Lot 87 Qualification Code _____
Work Site Location 1669 21st Ave

Owner in Fee: Frank Ferguson

Tel. (732) 395 0477 e-mail _____

Address 1669 21st Ave Municipality _____ Zip code _____

Contractor: Guadalupe Electric Tel. (732) 223 _____

Address 706 E Main St e-mail _____

Contractor License No. _____ Exp. Date _____

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

Federal Emp. ID No. _____ FAX: (____) _____

B. ELECTRICAL CHARACTERISTICS

Use Group _____ Present _____ Proposed _____

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

Building Occupied as Business Utility Co. _____

Est. Cost of Elec. Work \$ 4423.00

JOB SUMMARY (Office Use Only)

PLAN REVIEW		INSPECTIONS		Dates (Month/Day)	
[] No Plans Required					
[] Partial - Underslab Utilities Approved					
Date: _____	Approved by: _____				
[] Electric Plans Approved					
Date: _____	Approved by: _____				
Joint Plan Review Required:					
[] Bldg. [] Plumb. [] Fire. [] Elev.					
SUBCODE APPROVAL for PERMIT					
Date: _____	Approved by: _____				
SUBCODE APPROVAL for CERTIFICATE					
[] CO [] CCO [] CA					
Date: _____	Approved by: _____				

U.C.C. F120 (rev 11/09)

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: _____

Print name here: _____

[X] Licensed Elec. Contractor [] Certifd Landscape Irrigation Contr [] Exempt Applicant

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK: 220V 50/60 Hz System

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	
		<u>Sub Panels</u>	
		TOTAL NUMBERS	
		Pool Permit/with UV 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 1/4 HP	
		KW Transformer/Generator	
		AMP Service	
		AMP Subpanels <u>100/150</u>	
		AMP Motor Control Center	
		KW Elec. Sign/Outline Light	

Administrative Surcharge \$ _____

Minimum Fee \$ _____

State Permit Surcharge Fee \$ _____

TOTAL FEE \$ _____

To reorder call: ALLEGRA
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(609) 390-1400



ELECTRICAL SUBCODE TECHNICAL SECTION



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

Block 245 Lot 37 Qualification Code _____
Work Site Location 1609 Rt 88

Owner In Fee Garage
Address 1609 Rt 88

Tel (732) 245-0875

Contractor H. C. H. S.

Fax (732) _____

Federal Emp. No. _____

B. ELECTRICAL CHARACTERISTICS

Use Group Present _____ Proposed _____

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

Building Occupied as _____ Utility Co. _____

Est. Cost of Elec. Work \$ 6,000

JOB SUMMARY (Office Use Only)

PLAN REVIEW	Date	Initial	INSPECTIONS	Dates (Month/Day)
[] No Plans Required	Type:	Failure	Failure	Approval
Joint Plan Review Required:				
[] Building [] Plumbing	Rough			
[] Fire [] Elevator	Barrier-Free			
[] Elec. Plans Approved	Trench			
	Temp. Serv.			
	Const. Serv.			
	TCO			
	Other			
	Service			
	Final			
	Barrier-Free			
SUBCODE APPROVAL				
[] CO [] CCO [] CA	Temp. Cut-In-Card Date Issued			
	Final Cut-In-Card Date Issued			
	Annual Pool Inspection			
	Date of Grounding and Bonding			
Approved by: _____	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.

Date Received _____
Control # _____
Date Issued _____
Permit # _____

Applicant's Signature/Contractor's Seal and Signature _____

D. TECHNICAL SITE DATA

QTY. SIZE ITEMS

- 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 UV 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 1/4 HP
- KW Transformer/Generator
- AMP Service
- AMP Subpanels
- AMP Motor Control Center
- KW Elec. Sign/Outline Light

FEE (Office Use Only)

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



ELECTRICAL SUBCODE TECHNICAL SECTION



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 _____
Address _____

Tel (____) _____
Contractor _____
Address _____

Fax (____) _____
Contractor License No. _____
Federal Emp. No. _____

B. ELECTRICAL CHARACTERISTICS

Use Group Present _____ Proposed _____
☐ Pole/Pad # _____ ☐ Temporary ☐ Other _____
Building Occupied as _____ Utility Co. _____
Est. Cost of Elec. Work \$ _____

JOB SUMMARY (Office Use Only)

PLAN REVIEW	Date	Initial	INSPECTIONS	Dates (Month/Day)			
			Type:	Failure	Failure	Approval	Initial
☐ No Plans Required			Rough				
Joint Plan Review Required:			Barrier-Free				
☐ Building ☐ Plumbing			Trench				
☐ Fire ☐ Elevator			Temp. Serv.				
☒ Elec. Plans Approved			Constr. Serv.				
Date: _____			TCO				
Approved by: _____			Other				
			Service				
			Final				
			Barrier-Free				
SUBCODE APPROVAL							
☐ CO ☐ CCO ☐ CA			Temp. Cut-in-Card Date Issued				
Date: _____			Final Cut-in-Card Date Issued				
Approved by: _____			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.

Date Received _____
Control # _____
Date Issued _____
Permit # _____

Applicant's Signature/Contractor's Seal and Signature

D. TECHNICAL SITE DATA

☐ Licensed Elec. Contractor ☐ Certified Landscape Irrigation Contr. ☐ Exempt Applicant

QTY.	SIZE	ITEMS
		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 UV 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 1/4 HP _____
KW Transformer/Generator _____
AMP Service _____
AMP Subpanels _____
AMP Motor Control Center _____
KW Elec. Sign/Outline Light _____

Fee (Office Use Only)

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

Structural Support

1212 Main Street

Belmar NJ 07719

September 26, 2011

Mr. Michael Vecchio
Subcode Official
401 Chambers Bridge Road
Brick NJ 08723

Project Address: 1669 Route 88
Brick NJ 08753

Municipality: Brick

County: Ocean

Block:

Lot:

Permit:

Project Description: Installation of Solar Panels on Roof

Mr. Vecchio,

This letter provides basic information for proposed solar panel installation, as requested. See complete specifications (dated 8-23-11) provided separately for detailed requirements.

Attached plan ("Plan of Rails & Base Mounts") shows locations of rails that will support 4 rows of solar panels, along with mounts that support rails. Each mount is to be connected to rafter with 5/16" lag screw. Total number of solar panels (84) is noted.

Rail-support mounts shall be installed at 48-inch maximum spacing and shall be staggered as shown on the plan.

- ☒ Roof framing has adequate capacity to support design loads from proposed solar panel system, with rails and mounts located as shown on attached plan.

Design loads are based on the following basic requirements per IRC 2009 NJ;

Ground Snow Load 20 psf
Basic Wind Speed 115 mph

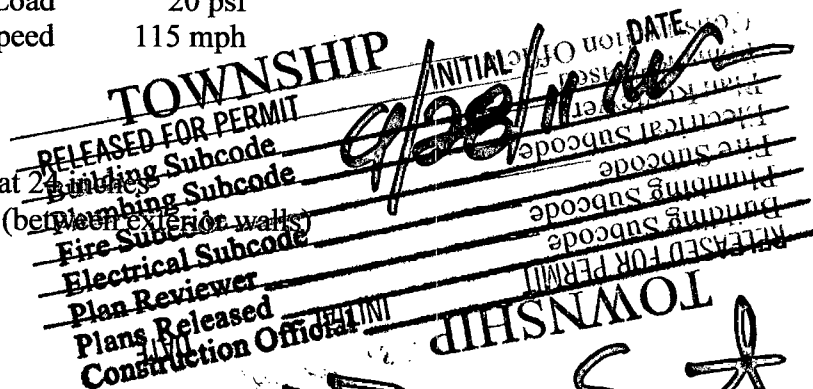
Roof Framing

Prefabricated wood roof trusses, at 24" on center
Horizontal span length = 41'-10" (between exterior walls)

Please call with any questions.



John F Mann, PE
GE29049

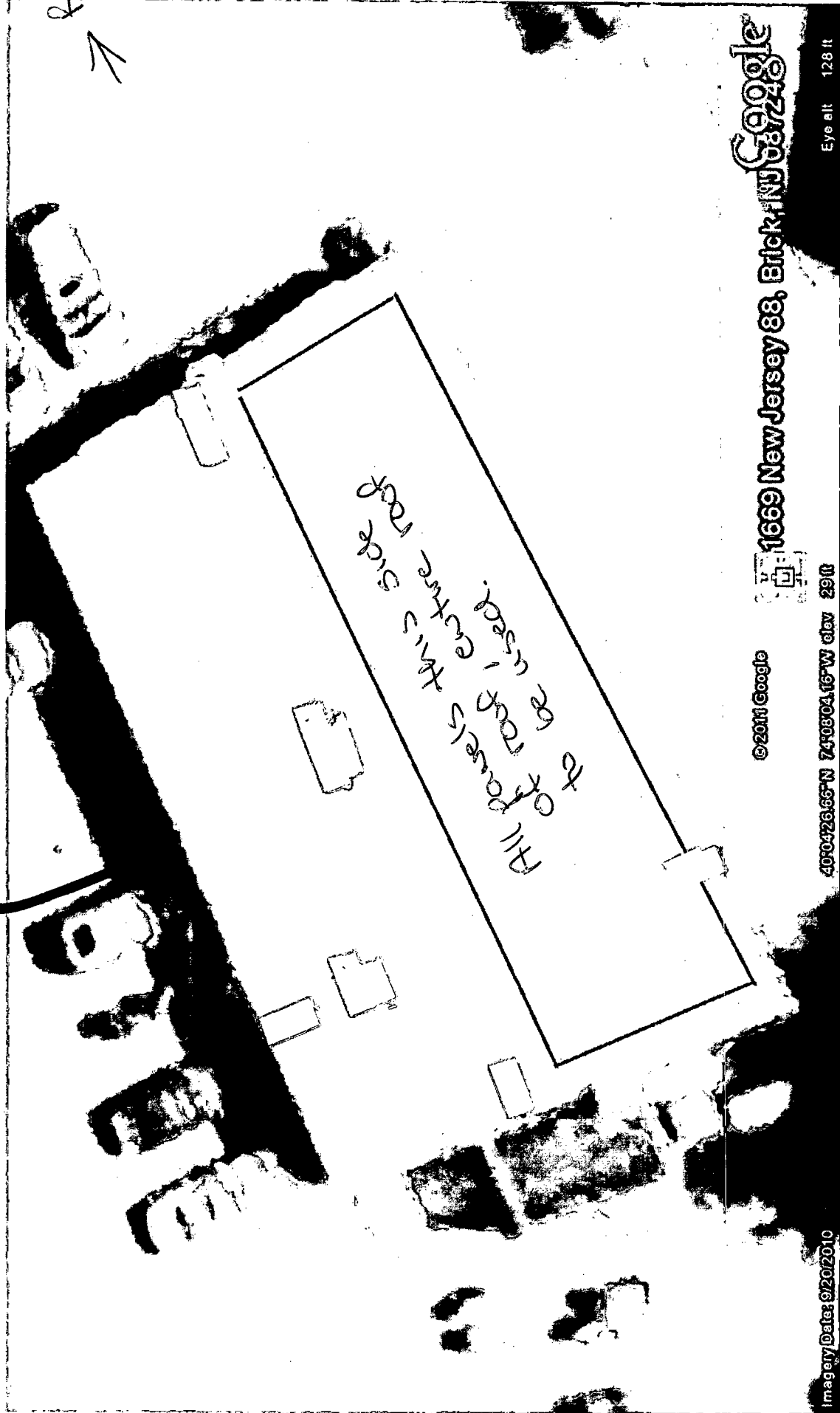


Copies; Gary Shible
Steve Whitman Solar, Point Pleasant NJ



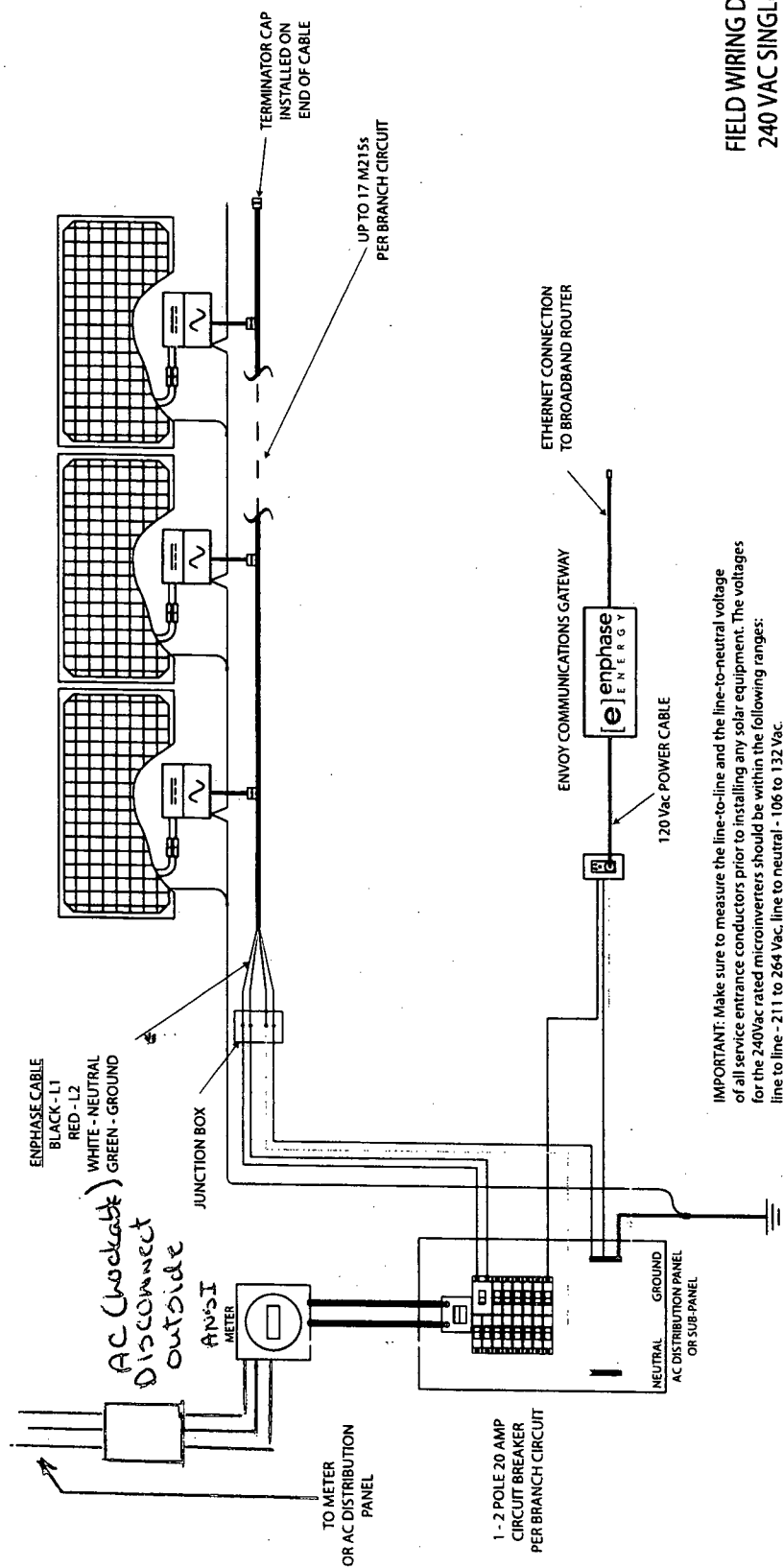
Handwritten signature and date "9/27/11".

meter with panels inside 208 3phase



84 Modules with microinverters attached to rail system
under each module
22 Kw total system
Hoffmans street nearest cross street

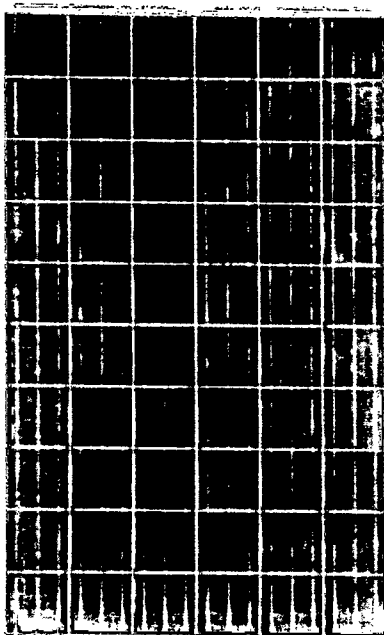
FIELD WIRING DIAGRAM 240 VAC SINGLE PHASE



Polycrystalline Solar Module

OVERVIEW

Hanwha SolarOne's SF220 Polycrystalline Module delivers the performance and efficiency required for large power output applications. Featuring a smooth, all-blue surface and a tight $\pm 3\%$ power tolerance, the SF220 Poly provides an aesthetically attractive and efficient option for commercial and utility installations. The module has undergone comprehensive testing for reliable performance over time and is certified to comply with the latest Class A safety standards.



KEY TECHNICAL FEATURES

- 5 year product warranty, 25 year performance warranty*
- Module certified to withstand high snow loads, up to 5.4kN/m^{2**}
- Tight power tolerance: $\pm 3\%$, anti-reflective coating
- Free module recycling through membership in PV Cycle

*Please refer to Hanwha SolarOne Product Warranty for details.

**Please refer to Hanwha SolarOne module Installation Guide.

QUALITY AND ENVIRONMENTAL CERTIFICATES

- ISO 9001 quality standards and ISO 14001 environmental standards
- OHSAS 18001 occupational health and safety standards
- IEC 61215 and IEC 61730 Class A certifications
- Conformity to CE

ABOUT HANWHA SOLARONE

Hanwha SolarOne is a vertically integrated manufacturer of photovoltaic modules designed to meet the demands of the global energy consumer. From high-grade crystalline silicon, to module production, to project development and financing, Hanwha SolarOne is setting the new standard in innovation and value.

- High reliability, guaranteed quality, and excellent cost-efficiency due to vertically integrated production and control of the supply chain;
- Optimization of product performance and manufacturing processes through a strong commitment to research and development;
- Global presence throughout Europe, North America, and Asia, offering regional technical and sales support.

**Hanwha SolarOne**www.hanwha-solarone.com

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at Standard Test Conditions (STC)

MAXIMUM POWER (P _{max})	223W	230W	235W	240W	245W	250W
OPEN CIRCUIT VOLTAGE (V _{oc})	36.7V	36.8V	36.8V	37.0V	37.1V	37.2V
SHORT CIRCUIT CURRENT (I _{sc})	8.18A	8.34A	8.44A	8.54A	8.64A	8.74A
VOLTAGE AT MAXIMUM POWER (V _{mp})	29.9V	30.0V	30.1V	30.2V	30.3V	30.4V
CURRENT AT MAXIMUM POWER (I _{mp})	7.53A	7.67A	7.81A	7.95A	8.08A	8.22A
MODULE EFFICIENCY (%)	13.6	13.9	14.2	14.5	14.8	15.1

P_{max}, V_{oc}, I_{sc}, V_{mp}, I_{mp} based on STC data and as measured at 1000W/m² of AM 1.5G irradiance and cell temperature 25 ± 0.5°C. Power tolerance of ±3% for all modules and performance.

Electrical Characteristics at Normal Operating Cell Temperature (NOCT)

MAXIMUM POWER (P _{max})	163W	167W	170W	174W	178W	182W
OPEN CIRCUIT VOLTAGE (V _{oc})	33.1V	33.3V	33.5V	33.7V	34.1V	34.2V
SHORT CIRCUIT CURRENT (I _{sc})	6.50A	6.66A	6.74A	6.84A	6.99A	7.07A
VOLTAGE AT MAXIMUM POWER (V _{mp})	27.1V	27.2V	27.3V	27.4V	27.6V	27.7V
CURRENT AT MAXIMUM POWER (I _{mp})	6.02A	6.14A	6.23A	6.35A	6.46A	6.58A
MODULE EFFICIENCY (%)	12.3	12.6	12.9	13.2	13.5	13.8

P_{max}, V_{oc}, I_{sc}, V_{mp}, I_{mp} based on STC data and as measured at 1000W/m² of AM 1.5G irradiance and cell temperature 25 ± 0.5°C. Power tolerance of ±3% for all modules and performance.

Temperature Characteristics

NORMAL OPERATING CELL TEMPERATURE (NOCT)	45 ± 3°C
TEMPERATURE COEFFICIENTS OF P	-0.45%/°C
TEMPERATURE COEFFICIENTS OF V	-0.32%/°C
TEMPERATURE COEFFICIENTS OF I	-0.04%/°C

Maximum Ratings

MAXIMUM SYSTEM VOLTAGE	1000V (IEC); 600V (UL)
SERIES FUSE RATING	15A
MAXIMUM REVERSE CURRENT	Series fuse rating multiplied by 1.35

MECHANICAL CHARACTERISTICS

DIMENSIONS	1652mm x 1000mm x 45mm (65.04 in x 39.37 in x 1.77 in)
WEIGHT	21kg (46.2 lbs)
FRAME	Aluminum alloy
FRONT	Tempered glass
ENCAPSULANT	EVA
BACK COVER	Composite sheet
CELL TECHNOLOGY	Polycrystalline
CELL SIZE	156mm x 156mm (6.14 in x 6.14 in)
NUMBER OF CELLS (Pieces)	60 (6 x 10)
JUNCTION BOX	Protection class IP65 with bypass-diode
OUTPUT CABLES	Solar cable: 4mm ² ; length 900mm (35.4 in)
CONNECTOR	Linyang LY0706-2

SYSTEM DESIGN

OPERATING TEMPERATURE	-40°C to 85°C
HAIL SAFETY IMPACT VELOCITY	25mm at 23m/s
FIRE SAFETY CLASSIFICATION	Class C
STATIC LOAD WIND/SNOW	5.4kN/m ²

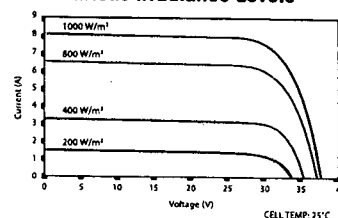
PACKAGING AND STORAGE

STORAGE TEMPERATURE	-40°C to 85°C
PACKAGING CONFIGURATION	22 pcs per pallet
LOADING CAPACITY (40 FT. CONTAINER)	572 pieces

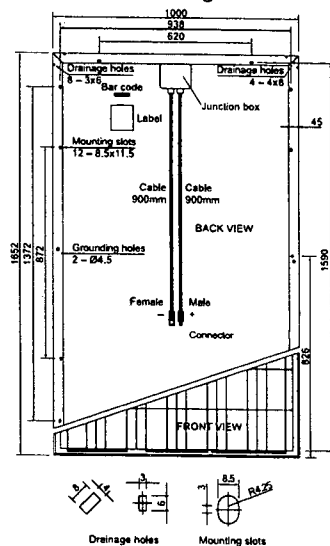
Performance at Low Irradiance:

The typical relative change in module efficiency at an irradiance of 200W/m² in relation to 1000W/m² (both at 25°C and AM 1.5G spectrum) is less than 5%.

Various Irradiance Levels



Basic Design



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Hanwha SolarOne

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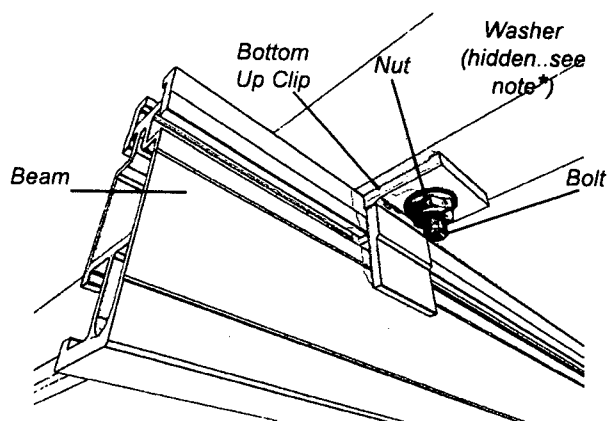
SolarMount Technical Datasheet

Pub 100602-1td V1.0 June 2010

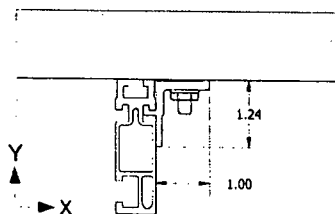
SolarMount Module Connection Hardware	1
Bottom Up Module Clip.....	1
Mid Clamp	2
End Clamp.....	2
SolarMount Beam Connection Hardware	3
L-Foot	3
SolarMount Beams	4

SolarMount Module Connection Hardware

SolarMount Bottom Up Module Clip Part No. 321001, 321002



- **Bottom Up Clip material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear Anodized
- **Bottom Up Clip weight:** ~0.031 lbs (14g)
- Allowable and design loads are valid when components are assembled with SolarMount series beams according to authorized UNIRAC documents
- Assemble with one 1/4"-20 ASTM F593 bolt, one 1/4"-20 ASTM F594 serrated flange nut, and one 1/4" flat washer
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
- Module edge must be fully supported by the beam
- * **NOTE ON WASHER:** Install washer on bolt head side of assembly. **DO NOT** install washer under serrated flange nut

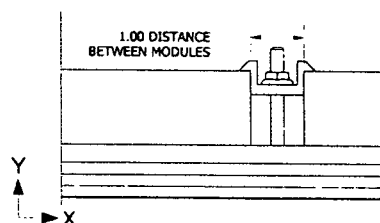
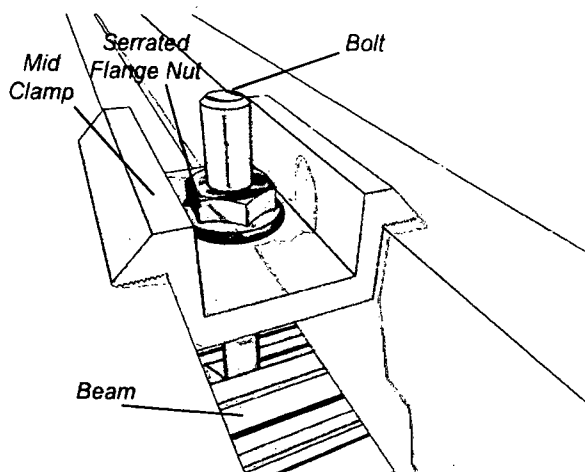


Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, ϕ
Tension, Y+	1566 (6967)	686 (3052)	2.28	1038 (4615)	0.662
Transverse, X±	1128 (5019)	329 (1463)	3.43	497 (2213)	0.441
Sliding, Z±	66 (292)	27 (119)	2.44	41 (181)	0.619

Dimensions specified in inches unless noted

SolarMount Mid Clamp

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



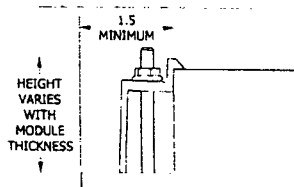
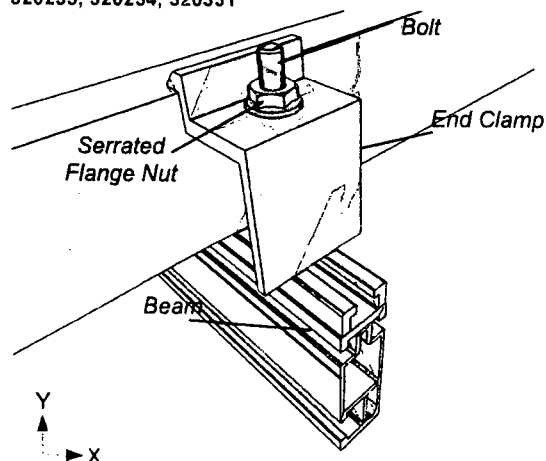
Dimensions specified in inches unless noted

- **Mid clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **Mid clamp weight:** 0.050 lbs (23g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single mid clamp assembly when used with a SolarMount series beam to retain a module in the direction indicated
- Assemble mid clamp with one Unirac ¼"-20 T-bolt and one ¼"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory

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

SolarMount End Clamp

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



Dimensions specified in inches unless noted

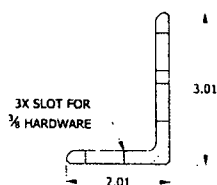
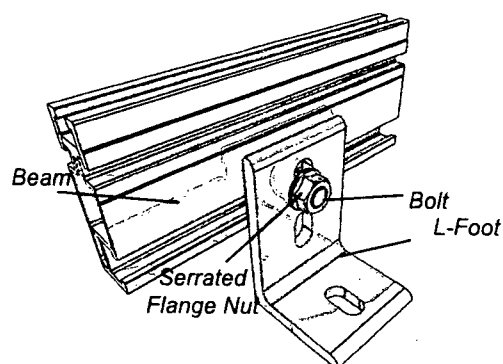
- **End clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **End clamp weight:** varies based on height: ~0.058 lbs (26g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single end clamp assembly when used with a SolarMount series beam to retain a module in the direction indicated
- Assemble with one Unirac ¼"-20 T-bolt and one ¼"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
- Modules must be installed at least 1.5 in from either end of a beam

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

SolarMount Beam Connection Hardware

SolarMount L-Foot

Part No. 310065, 310066, 310067, 310068



Dimensions specified in inches unless noted

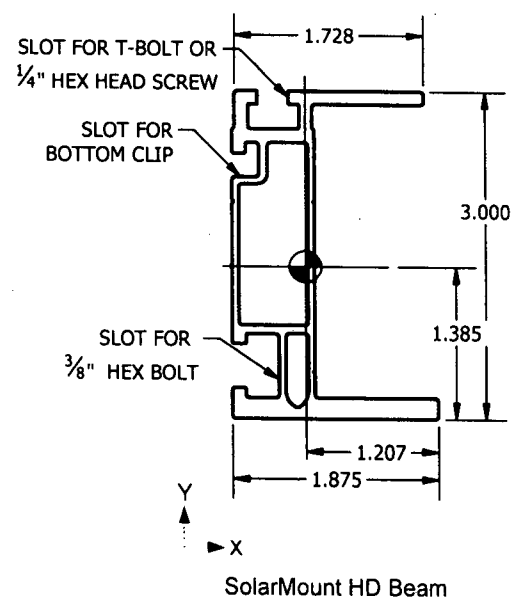
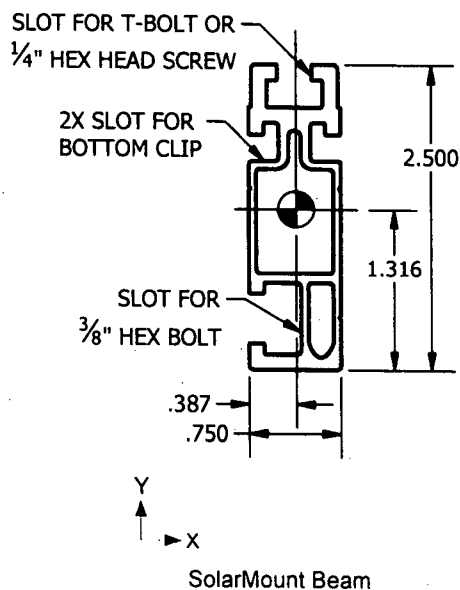
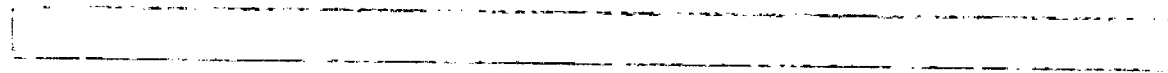
- **L-Foot material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **L-Foot weight:** varies based on height: ~0.215 lbs (98g)
- Allowable and design loads are valid when components are assembled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

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

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

SolarMount Beams

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



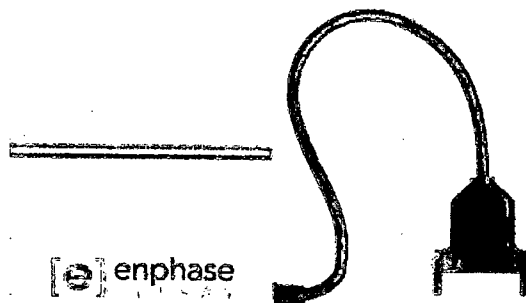
Dimensions specified in inches unless noted

M215 Microinverter Installation Planning

The Enphase M215 Microinverter

The M215 Microinverter is Enphase's most powerful and efficient model yet. This grid-tied microinverter is compatible with most 60-cell PV modules (up to 260W) and installs quickly and easily. It works with both three-phase 208 Vac or single-phase 240 Vac services in North America; voltage is determined by cable type.

For detailed installation information, refer to the **M215 Installation and Operations Manual** and the **M215 Quick Install Guide** at <http://www.enphase.com/support/downloads>.



Microinverter Compatibility

The M215 should be paired only with a 60-cell PV module. Refer to the Enphase website (<http://www.enphase.com/support/downloads>) for a list of **electrically**-compatible PV modules and approved PV module racking systems.

To ensure **mechanical** compatibility, be sure to order the correct Module Connector Type for both microinverter and PV module from your distributor.

Model Number	Electrical Compatibility	Module Connector Type
M215-60-2LL-S22 M215-60-2LL-S22-NA	60 cell PV module	MC-4 Type 2 Locking or Amphenol H4 Locking
M215-60-2LL-S23 M215-60-2LL-S23-NA	60 cell PV module	Tyco Solarlock Locking*

***Note:** Tyco connectors on PV modules can vary in polarity, and either the male or female connector may be positive. Only the MALE positive will mate with Enphase Microinverters with S23 connectors. Be sure to order the correct connector type for both microinverter and PV module from your distributor.

As a rule, the electrically-positive output of the PV module always connects to the positive input of the microinverter. However, PV modules come with a variety of labels. For more information, refer to **Mating Microinverters with PV Modules for Correct Polarity** under the Enphase downloads at <http://www.enphase.com/support/downloads>.

Branch Circuit Capacity

Do not exceed the maximum number of microinverters in an AC branch circuit as listed in the following table. You must protect each microinverter AC branch circuit with a 20A maximum breaker.

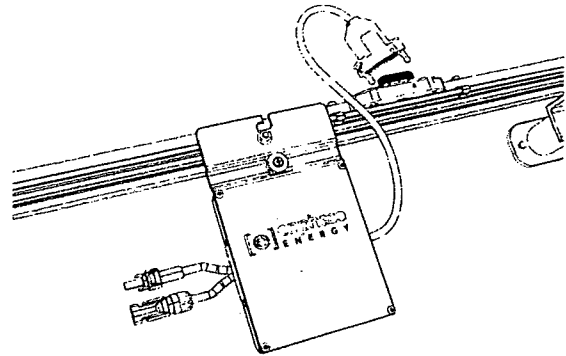
Maximum number of M215s per 20 amp AC Branch Circuit	
Service type	Max M215s per AC branch
240V	17
208V	25

Enphase Engage Cabling System

The M215 incorporates DC connectors and an AC connector. There is no integral AC cable on the M215. The Enphase Cabling System accomplishes the AC connection.

The Cabling System is a continuous length of 12 AWG, outdoor rated cable, with integrated connectors for microinverters. These connectors are preinstalled along the entire cable and spaced to accommodate both portrait and landscape PV module orientations.

The cable is installed by simply rolling out the desired length of cable and cutting it to size. One end is wired directly into the junction box at the head of the branch circuit, eliminating the need for a separate AC interconnect cable. The other end is sealed from the environment using an Enphase Branch Terminator. The M215 AC cable connectors are then plugged into the regularly-spaced connectors as shown.

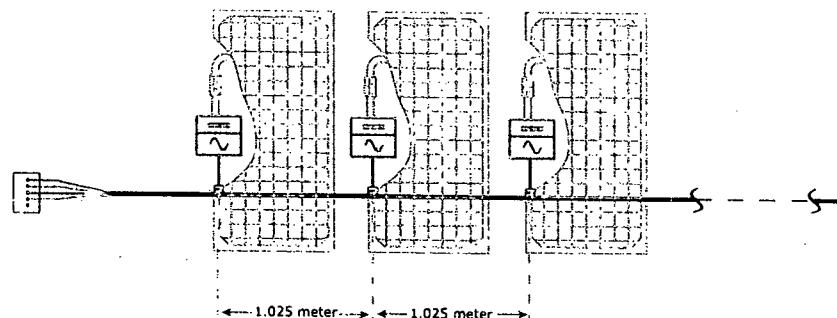


The Enphase Cabling System is available in two connector spacing options and two voltage types. Depending upon installer needs, the cabling is also available in a variety of lengths.

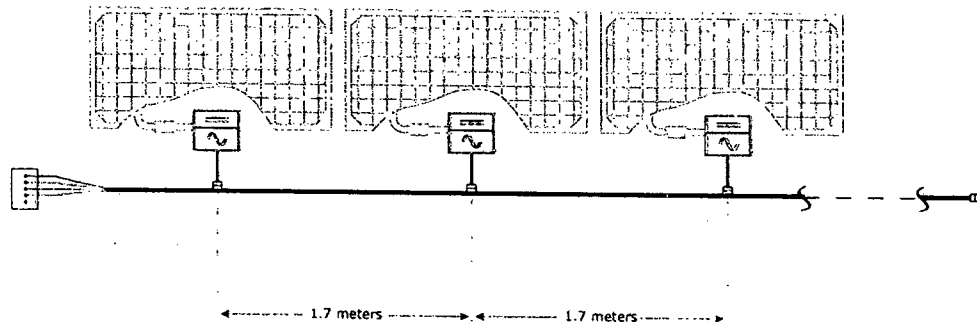
Connector Spacing Options

The gap between connectors on the cable can be either 1.025 meters (40") or 1.7 meters (67"). The 1.025 meter spacing is best suited for connecting PV modules installed in portrait mode, while the 1.7 meter gap is best suited to PV modules installed in landscape mode.

Cabling with drop connectors spaced at 1.025 meter (40") for portrait installs

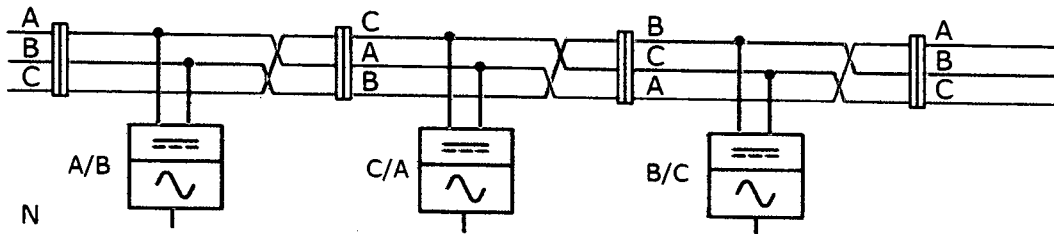


Cabling with drop connectors spaced at 1.7 meters (67") for landscape installs



Voltage Types and Conductor Count

The voltage types are either 240VAC split phase or 208VAC three phase. **All cable connectors bear labels indicating their cable voltage designation.** Typically used for residential applications, 240VAC includes four conductors. This cabling should also be used for split phase 208VAC applications. Three-phase 208VAC cabling includes five conductors, and is used for most commercial installations. Because Enphase microinverters output onto two phases, three phase cabling balances the phases by rotating conductor use from one microinverter to the next as shown in the following diagram. In the diagram, the three phases are labeled A, B, and C.



Racking Compatibility

Engage Cabling is compatible with a variety of racking systems. For a list of approved PV module racking types, refer to the Racking Compatibility document at (<http://www.enphase.com/support/downloads>).

Cabling Length Options

Engage Cabling is available in shorter lengths with 30-40 connectors, depending upon voltage type. Longer lengths can be ordered and cut to suit per order. Ordering options include:

Model Number	Voltage type/ conductor #	Connector count	Connector spacing	PV module orientation	Approx. weight
ET10-240-40	240VAC, 4 conductor	40 connectors	1.025 m (40")	Portrait	18.1 kg (40 lbs)
ET17-240-40	240VAC, 4 conductor	40 connectors	1.7 m (67")	Landscape	20.4 kg (45 lbs)
ET10-208-30	208VAC, 5 conductor	30 connectors	1.025 m (40")	Portrait	13.6 kg (30 lbs)
ET17-208-30	208VAC, 5 conductor	30 connectors	1.7 m (67")	Landscape	15.9 kg (35 lbs)
ET10-240-BULK	240VAC, 4 conductor	240 connectors	1.025 m (40")	Portrait	over 90 kg (200 lbs)
ET17-240-BULK	240VAC, 4 conductor	240 connectors	1.7 m (67")	Landscape	over 90 kg (200 lbs)
ET10-208-BULK	208VAC, 5 conductor	240 connectors	1.025 m (40")	Portrait	over 90 kg (200 lbs)
ET17-208-BULK	208VAC, 5 conductor	240 connectors	1.7 m (67")	Landscape	over 90 kg (200 lbs)



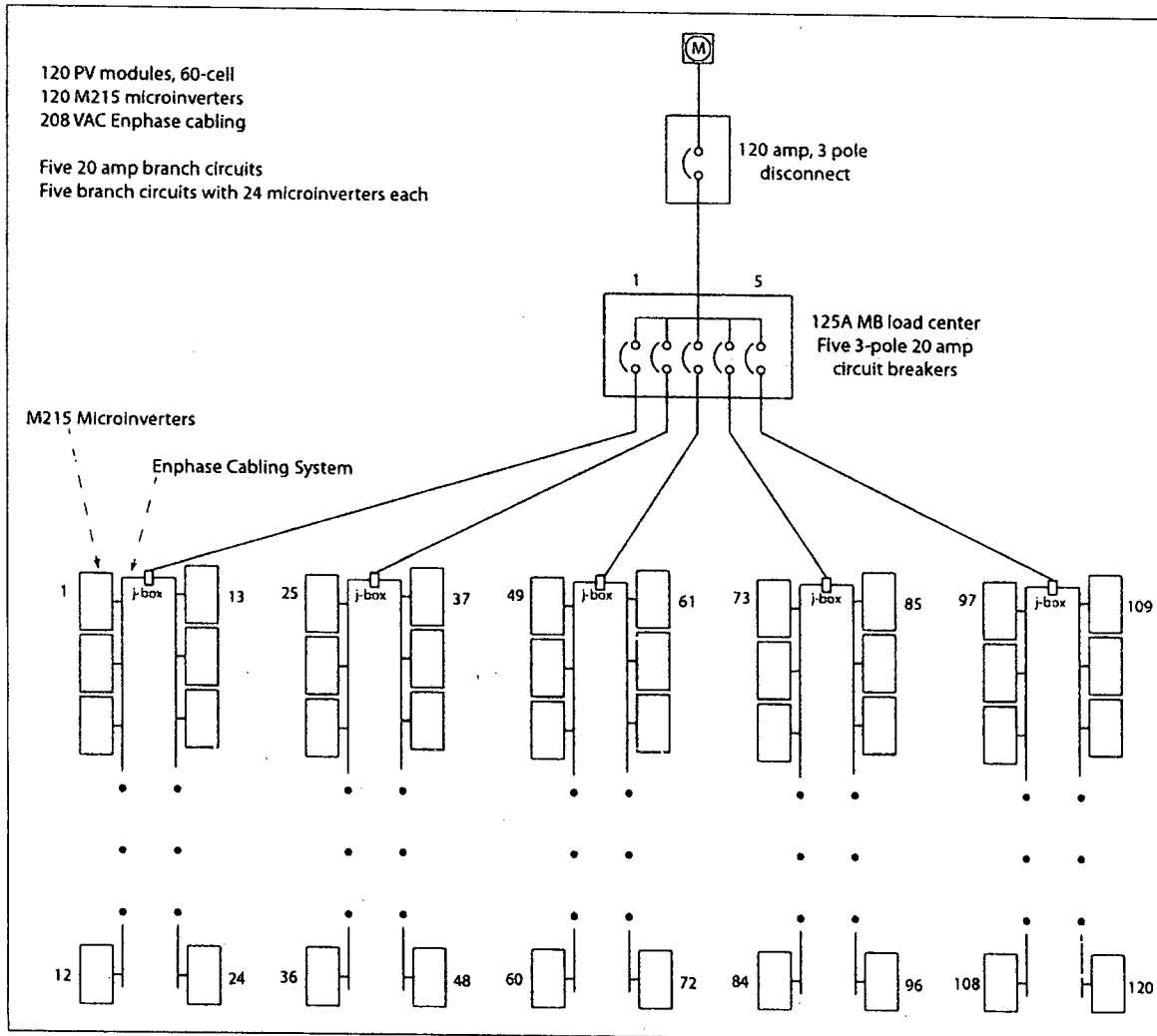
Planning for Cable Lengths and Type

The Cabling System is flexible enough to adapt to almost any solar design. To determine the length and cable type that you need, take into account the following considerations:

- **The number of Enphase Microinverters to be installed on the AC branch.** Be certain to allocate the correct number of connectors, including extra connectors for gaps and turns.
- **Additional length required to reach from the AC branch circuit junction box to the first microinverter.** If greater than half a connector cable interval is needed, it may be necessary to include one (or more) unused connectors in order to span this distance. Unused connectors must be covered with Enphase watertight sealing caps.
- **Additional length required to reach from one row of PV modules to the next.** If the PV modules are laid out in multiple rows, the distance from one row to the next often requires additional cabling length.
- **Bend radius.** When planning cabling turns or loops, you must account for a minimum bend radius of 6.7 cm (2.625").
- **Multiple sub-arrays.** Often, the AC branch circuit may be composed of several smaller sub-arrays across more than one roof plane. In this case, the cable is cut to service each smaller array, and the sub-arrays are connected together using appropriately rated runs of conduit. The transition from cable to conduit is accomplished using an outdoor rated junction box, as required by the NEC and local code. Unused connectors must be covered with Enphase watertight sealing caps.
- **Mixture of PV modules in both portrait and landscape installation.** Often, PV installations use modules installed in mixed orientation (both portrait and landscape mode). In this case there are three choices for cabling:
 1. Cabling with 1.025 meter spacing between connectors results in cleanest install for the modules in portrait mode. For modules placed in landscape mode, plan for an unused connector between each PV module to achieve the required additional distance. Unused connectors must be covered with Enphase watertight sealing caps.
 2. Cabling with 1.7 meter spacing between connectors results in cleanest install for the modules in landscape mode, but requires that any additional cable length between PV modules in portrait mode be coiled and dressed so that cabling does not contact the roof. Again, unused connectors must be covered with Enphase watertight sealing caps.
 3. Another solution when modules are installed in mixed orientation is to transition between 1.025 and 1.7 meter spacing cable options using an outdoor rated junction box. This junction box can be installed to the PV module railing.

Example Installation Layout and Parts Needed

The following installation diagram shows an example with five branches. The 208V layout shows five center-fed branches with 24 microinverters each. The PV modules are in landscape orientation. Tables following the diagram list required and optional equipment.



Enphase Items Required

Quantity	Description	Order Number
120	M215 Microinverter	M215-60-2LL-S22 or M215-60-2LL-S23
3 packs	Cable clips (each pack contains 100 clips)	ET-CLIP-100
1 pack	Disconnect tool (each pack contains five tools)	ET-DISC-05
1 pack	Branch Terminator (each pack contains 10 terminators)	ET-TERM-10
1	Enphase cabling divided into ten lengths: Each length should be about 20.4 meters (67 feet) with 12 connectors.	ET17-208-BULK
1 pack	Watertight sealing caps (Each pack contains 10). Required only if there are any unused connectors; Unused connectors must be covered with this cap.	ET-SEAL-10
1	Envoy Communications Gateway -or- LCF Envoy (Line Communications Filter) ¹	IEMU-03 ELCF-120-001

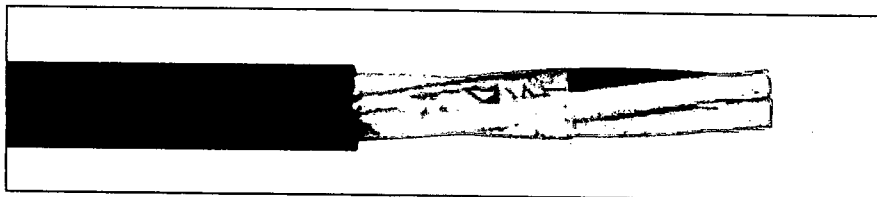
Non-Enphase Items Required

Quantity	Description
120	60-cell PV module
5	Weather-proof (NEMA) junction box
5	Three-pole 20 amp circuit breaker
1	Three-pole 120 amp circuit breaker
1	125 amp load center
1	Lightning protection device (3-phase AC surge protector)
as needed	Homerun conductors
as needed	Continuous grounding conductor or WEEB
as needed	Torque wrench, sockets, wrenches for mounting hardware
as needed	Adjustable wrench or open-ended wrench (for terminator caps)
as needed	Inspection mirror (for viewing indicator lights on the undersides of the microinverters)

¹ An LCF Envoy may be required for systems that are 30kW in size or larger.

FREP®

FR-EPR/CPE, Control, Unshielded
600V, UL Type TC-ER¹—E-2 Color Code



CATALOG NUMBER	NO. OF COND.	COND. SIZE (AWG)	COND. STRAND	MINIMUM AVG. INSULATION THICKNESS		MINIMUM AVG. JACKET THICKNESS		NOMINAL CABLE O.D.		COPPER WEIGHT		NET WEIGHT	
				INCHES	mm	INCHES	mm	INCHES	mm	lbs/ 1000ft	kg/km	lbs/ 1000ft	k

14 AWG MULTI CONDUCTORS

279560	2 Flat	14	7/0.242	0.030	0.76	0.045	1.14	.365x.230	9.3x5.8	26	38	61	91
305320*	2	14	7/0.242	0.030	0.76	0.045	1.14	0.370	9.40	26	39	71	106
280180	3	14	7/0.242	0.030	0.76	0.045	1.14	0.390	9.91	39	59	92	137
280190	4	14	7/0.242	0.030	0.76	0.045	1.14	0.425	10.80	53	78	115	171
279870	5	14	7/0.242	0.030	0.76	0.045	1.14	0.465	11.81	66	98	139	207
280200	7	14	7/0.242	0.030	0.76	0.045	1.14	0.505	12.83	92	137	173	257
280210	9	14	7/0.242	0.030	0.76	0.060	1.52	0.620	15.75	118	176	240	357
279880	12	14	7/0.242	0.030	0.76	0.060	1.52	0.700	17.78	158	235	301	448
279580*	19	14	7/0.242	0.030	0.76	0.060	1.52	0.815	20.70	250	372	468	696
279590	25	14	7/0.242	0.030	0.76	0.080	2.03	0.935	23.75	323	481	624	929
347080*	30	14	7/0.242	0.030	0.76	0.080	2.03	1.030	26.16	387	576	747	1112
279600*	37	14	7/0.242	0.030	0.76	0.080	2.03	1.110	28.19	466	694	875	1302

12 AWG MULTI CONDUCTORS

279840	2 Flat	12	7/0.305	0.030	0.76	0.045	1.14	.400x.245	10.2x6.2	40	60	82	122
307690*	2	12	7/0.305	0.030	0.76	0.045	1.14	0.410	10.41	41	61	94	140
280170	3+ Gnd	12	7/0.305	0.030	0.76	0.045	1.14	0.410	10.41	85	127	148	220
280300	3	12	7/0.305	0.030	0.76	0.045	1.14	0.435	11.05	64	95	124	185
280310	4	12	7/0.305	0.030	0.76	0.045	1.14	0.475	12.07	85	127	157	234
280320	5	12	7/0.305	0.030	0.76	0.045	1.14	0.520	13.21	106	158	191	284
279890	7	12	7/0.305	0.030	0.76	0.060	1.52	0.595	15.11	149	221	268	399
280330	9	12	7/0.305	0.030	0.76	0.060	1.52	0.695	17.65	191	285	337	502
280340	12	12	7/0.305	0.030	0.76	0.060	1.52	0.765	19.43	247	368	428	637
279610	19	12	7/0.305	0.030	0.76	0.080	2.03	0.940	23.88	391	582	688	1024
295400*	25	12	7/0.305	0.030	0.76	0.080	2.03	1.095	27.81	515	767	854	1271
347100*	30	12	7/0.305	0.030	0.76	0.080	2.03	1.150	29.21	618	920	1002	1491
301870	37	12	7/0.305	0.030	0.76	0.080	2.03	1.240	31.50	762	1134	1240	1845

10 AWG MULTI CONDUCTORS

279570	2 Flat	10	7/0.385	0.030	0.76	0.045	1.14	.445x.270	11.3x6.9	64	95	113	168
305340*	2	10	7/0.385	0.030	0.76	0.045	1.14	0.455	11.56	65	97	128	190
279680	3+ Gnd	10	7/0.385	0.030	0.76	0.045	1.14	0.485	12.32	134	199	225	335
280410	3	10	7/0.385	0.030	0.76	0.045	1.14	0.485	12.32	100	150	172	256
279900	4	10	7/0.385	0.030	0.76	0.060	1.52	0.560	14.22	134	199	234	348
279620	5	10	7/0.385	0.030	0.76	0.060	1.52	0.615	15.62	167	249	284	423
279630	7	10	7/0.385	0.030	0.76	0.060	1.52	0.670	17.02	234	349	381	567
279640	9	10	7/0.385	0.030	0.76	0.060	1.52	0.760	19.30	295	440	464	691
279650	12	10	7/0.385	0.030	0.76	0.080	2.03	0.905	22.99	402	598	651	969

Dimensions and weights are nominal; subject to industry tolerances.

*Non-stock item, minimum runs apply. Please consult Customer Service for price and delivery.

¹Approved as TYPE TC-ER for Exposed Run applications of 3 or more conductors as defined by NEC.

Product Construction

Conductor:

- 14 AWG thru 10 AWG fully annealed stranded tinned copper per ASTM B33
- Class B stranding per ASTM B8

Insulation:

- Flame-retardant Ethylene Propylene Rubber (FR-EPR) Type II
- Color-coded: per ICEA Method 1; Table E-2 (Does not include white or green)

Jacket:

- Flame-retardant thermoplastic Chlorinated Polyethylene (CPE)

Print

- GENERAL CABLE® (WC) FREP® XX/C XXAWG EPR/CPE (UL) TYPE TC-ER¹ XHHW-2 CDRS 90°C WET OR DRY 600V DIR BUR SUN RES DAY/MONTH/YEAR OF MFG SEQUENTIAL FOOTAGE MARK

Options:

- 2kV version
- Bare copper conductor
- Class C stranding
- E-1 Color Code—See Spec 4310
- Overall shielded multi conductor
- Flame-retardant Cross-Linked Polyethylene (FR-XLPE) insulation
- Thermoplastic Low-Smoke, Zero-Halogen (LSZH) jacket
- Other constructions available upon request

Applications:

- In free air, raceways or direct burial
- In wet or dry locations
- Permitted for Exposed Run 'ER' use in accordance with NEC for 3 or more conductors
- Approved for direct burial, Class I, Div. 2 industrial hazardous locations per NEC

Features:

- Rated at 90°C wet or dry
- Ripcord applied to all cables with jacket thickness of 60 mils or less
- Excellent physical, thermal and electrical properties
- Sunlight- and weather-resistant
- Excellent moisture resistance
- Excellent resistance to compression cuts and heat deformation
- Low coefficient of friction for easy pulling
- Excellent flame resistance—burns to ash; does not exhibit thermoplastic drip
- Excellent low temperature cold bend characteristics
- Meets cold bend test at -40°C
- Meets the crush and impact requirements of Type MC cable for 3 or more conductors

Compliance:

- Industry Compliance:**
 - UL 44 Type XHHW-2
 - UL 1277 Type TC-ER for 3 or more conductors
 - UL 1581
 - ICEA S-73-532
- Flame Tests Compliance:**
 - UL 1581 VW-1
 - UL 1277
 - IEEE 383
 - IEEE 1202
 - CSA FT-4
 - ICEA T-29-520

Other Compliance:

- EPA 40 CFR, Part 261 for leachable lead content per TCLP
- OSHA acceptable

Packaging:

- Material cut to length and shipped on non-returnable wood reels



General Cable
Phone: 888-593-3355
www.generalcable.com



BUILDING SUBCODE TECHNICAL SECTION



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

Block 335 Lot 37 Qualification Code _____
Work Site Location 1669 Rt 188 Brick

Owner in Fee: Gang's Graphics
Tel. () _____ e-mail _____

Address 1669 Rt 188 Brick Municipality _____ Zip code _____

Contractor: Chin + Chan Construction Tel. 732-295-0875 e-mail _____
Address 2511 Lawrence Rd. e-mail _____

Contractor License No. or Builder Registration No. 13V72663100 Exp. Date 12/31/11
Home Improvement Contractor Registration No. or Exemption Reason (if applicable): _____

Federal Emp. ID No. _____ FAX: () _____

JOB SUMMARY (Office Use Only)		PLAN REVIEW		Date		Initial		INSPECTIONS		Type:		Failure		Failure		Approval		Initial	
☐	No Plans Required																		
☒	All <u>9/28/11</u>																		
☐	Footings/Foundations																		
☐	Structural/Framework																		
☐	Exterior																		
☐	Interior																		
☐	Joint Plan Review Required:																		
☐	Ele. ☐ Plumb. ☐ Fire ☐ Elevator																		
☐	SUBCODE APPROVAL for PERMIT																		
☐	Approved by: _____																		
☐	SUBCODE APPROVAL for CERTIFICATE																		
☐	CO ☐ CCO ☐ CA																		
☐	Date: _____																		
☐	Approved by: _____																		
☐	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 _____

Const. Class Present _____ Proposed _____
If Industrialized Building: State Approved _____ HUD _____

Est. Cost of Bldg. Work: _____
1. New Bldg. \$ _____
2. Rehabilitation \$ _____
3. Total (1+2) \$ 95,000.00

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: Alexander Blumenthal

Print name here: Alexander Blumenthal

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK

Roofing-Installation of Solar panels

TYPE OF WORK:

- ☐ New Building
- ☐ Addition
- ☐ Rehabilitation
- ☐ Roofing
- ☐ Siding
- ☐ Fence _____ Height (exceeds 6') _____ Sq. Ft. _____
- ☐ Sign _____ Sq. Ft. _____
- ☐ Pool
- ☐ Retaining Wall _____ Sq. Ft. _____
- ☐ Asbestos Abatement Subchapter 8
- ☐ Lead Haz. Abatement NJAC 5:17
- ☐ Radon Remediation
- ☐ Other Solar panels
- ☐ Demolition

FEE (Office Use Only)

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

Date Received 10/3/11
Control # _____
Date Issued 11/11/2011
Permit # _____



BUILDING SUBCODE TECHNICAL SECTION



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

Block 1669 Lot 58 Qualification Code

Work Site Location

Owner In Fee: George L. Caputo

Tel. () e-mail

Address 1669 1st St. N. Jersey City, NJ 07310 Zip code 07310

Contractor: Municipality e-mail

Address 2001 1st St. N. Jersey City, NJ 07310 e-mail

Contractor License No. or Builder Registration No. Exp. Date 12/31/11

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

Federal Emp. ID No. FAX: ()

JOB SUMMARY (Office Use Only)		PLAN REVIEW		Date		Initial		INSPECTIONS		Type		Failure		Failure		Approval		Initial	
☐	No Plans Required																		
☒	All <u>9/11</u>																		
☐	Footings/Foundations																		
☐	Structural/Framework																		
☐	Exterior																		
☐	Interior																		
☐	Joint Plan Review Required:																		
☐	Elec. ☐ Plumb. ☐ Fire ☐ Elevator																		
SUBCODE APPROVAL for PERMIT																			
Date: <u> </u>																			
Approved by: <u> </u>																			
SUBCODE APPROVAL for CERTIFICATE																			
☐	CO	☐	CCO	☐	CA														
Date: <u> </u>																			
Approved by: <u> </u>																			

B. BUILDING CHARACTERISTICS

Use Group	Present	Proposed	Constr. Class	Present	Proposed
No. of Stories					
Height of Structure					
Area — Largest Floor					
New Bldg. Area/All Floors					
Volume of New Structure					
Max. Live Load					
Max. Occupancy Load					

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:

D. TECHNICAL SITE DATA

DESCRIPTION OF WORK

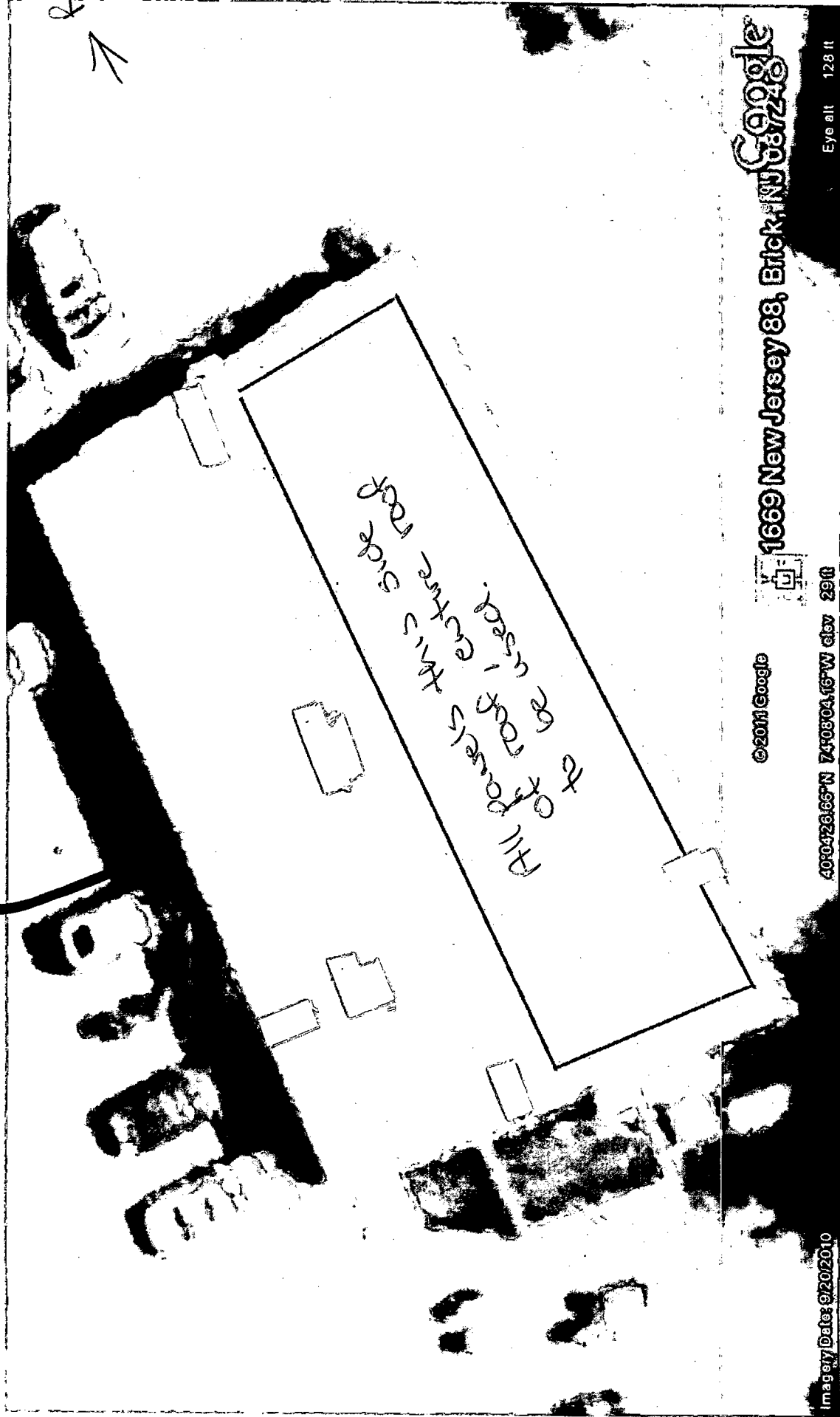
Footings Installation of Solar panels

TYPE OF WORK:	FEE (Office Use Only)
☐ New Building	
☐ Addition	
☐ Rehabilitation	
☐ Roofing	
☐ Siding	
☐ Fence	
☐ Sign	
☐ Pool	
☐ Retaining Wall	
☐ Asbestos Abatement Subchapter 8	
☐ Lead Haz. Abatement NJAC 5:17	
☐ Radon Remediation	
☐ Other <u>Solar panels</u>	
☐ Demolition	

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

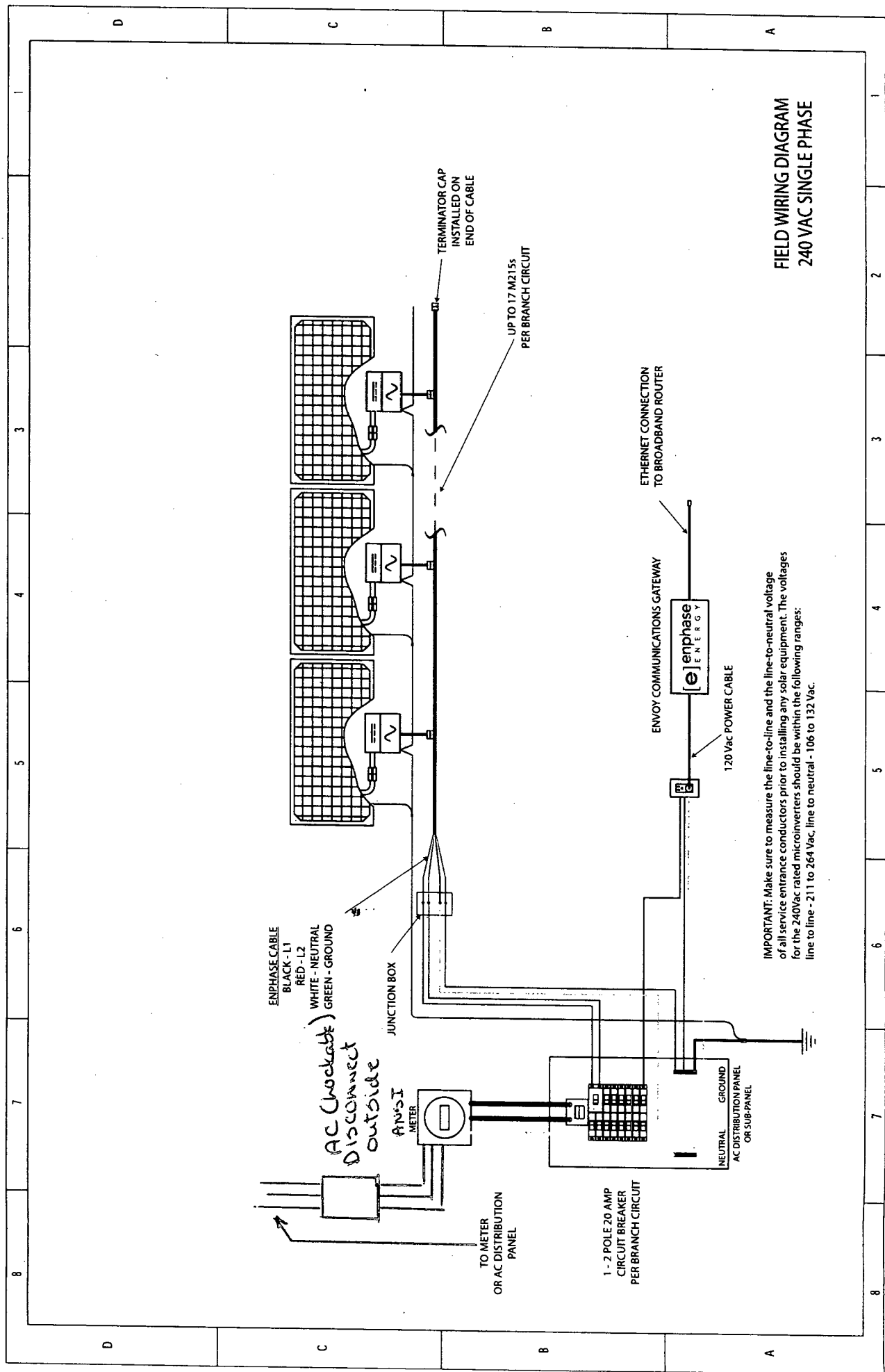
Date Received 10/3/11
Control #
Date Issued 11-24-11
Permit #

meter with panels inside 208 3phase



84 Modules with microinverters attached to rail system
under each module

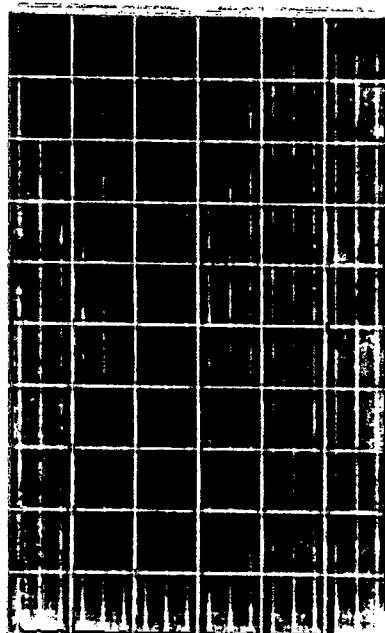
22 Kw total system
Hoffmans street nearest cross street



Polycrystalline Solar Module

OVERVIEW

Hanwha SolarOne's SF220 Polycrystalline Module delivers the performance and efficiency required for large power output applications. Featuring a smooth, all-blue surface and a tight $\pm 3\%$ power tolerance, the SF220 Poly provides an aesthetically attractive and efficient option for commercial and utility installations. The module has undergone comprehensive testing for reliable performance over time and is certified to comply with the latest Class A safety standards.



KEY TECHNICAL FEATURES

- 5 year product warranty, 25 year performance warranty*
- Module certified to withstand high snow loads, up to 5.4kN/m^{2**}
- Tight power tolerance: $\pm 3\%$, anti-reflective coating
- Free module recycling through membership in PV Cycle

* Please refer to Hanwha SolarOne Product Warranty for details.

** Please refer to Hanwha SolarOne module Installation Guide.

QUALITY AND ENVIRONMENTAL CERTIFICATES

- ISO 9001 quality standards and ISO 14001 environmental standards
- OHSAS 18001 occupational health and safety standards
- IEC 61215 and IEC 61730 Class A certifications
- Conformity to CE

ABOUT HANWHA SOLARONE

Hanwha SolarOne is a vertically integrated manufacturer of photovoltaic modules designed to meet the demands of the global energy consumer. From high-grade crystalline silicon, to module production, to project development and financing, Hanwha SolarOne is setting the new standard in innovation and value.

- High reliability, guaranteed quality, and excellent cost-efficiency due to vertically integrated production and control of the supply chain;
- Optimization of product performance and manufacturing processes through a strong commitment to research and development;
- Global presence throughout Europe, North America, and Asia, offering regional technical and sales support.



Hanwha SolarOne

www.hanwha-solarone.com

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at Standard Test Conditions (STC)

MAXIMUM POWER (P _{max})	23.5W	23.7W	23.8W	24.0W	24.5W	25.0W
OPEN CIRCUIT VOLTAGE (V _{oc})	36.7V	36.8V	36.8V	37.0V	37.1V	37.2V
SHORT CIRCUIT CURRENT (I _{sc})	8.18A	8.34A	8.44A	8.54A	8.64A	8.74A
VOLTAGE AT MAXIMUM POWER (V _{mp})	29.9V	30.0V	30.1V	30.2V	30.3V	30.4V
CURRENT AT MAXIMUM POWER (I _{mp})	7.53A	7.67A	7.81A	7.95A	8.08A	8.22A
MODULE EFFICIENCY (%)	13.6	13.9	14.2	14.5	14.8	15.1

P_{max}, V_{oc}, I_{sc}, and V_{mp} are measured at STC. The test is performed at 1000W/m² of AM 1.5G solar irradiance, a module temperature of 25 ± 2 °C, and a spectral irradiance of 1.5 ± 0.1 W/m² nm.

Electrical Characteristics at Normal Operating Cell Temperature (NOCT)

MAXIMUM POWER (P _{max})	18.3W	18.7W	19.0W	19.4W	19.8W	20.2W
OPEN CIRCUIT VOLTAGE (V _{oc})	33.1V	33.3V	33.5V	33.7V	34.1V	34.2V
SHORT CIRCUIT CURRENT (I _{sc})	6.50A	6.66A	6.74A	6.84A	6.99A	7.07A
VOLTAGE AT MAXIMUM POWER (V _{mp})	27.1V	27.2V	27.3V	27.4V	27.6V	27.7V
CURRENT AT MAXIMUM POWER (I _{mp})	6.02A	6.14A	6.23A	6.35A	6.46A	6.58A
MODULE EFFICIENCY (%)	12.3	12.6	12.9	13.2	13.5	13.8

P_{max}, V_{oc}, I_{sc}, and V_{mp} are measured at NOCT. The test is performed at 1000W/m² of AM 1.5G solar irradiance, a module temperature of 45 ± 2 °C, and a spectral irradiance of 1.5 ± 0.1 W/m² nm.

Temperature Characteristics

NORMAL OPERATING CELL TEMPERATURE (NOCT)	45 ± 3°C
TEMPERATURE COEFFICIENTS OF P	-0.45%/°C
TEMPERATURE COEFFICIENTS OF V	-0.32%/°C
TEMPERATURE COEFFICIENTS OF I	-0.04%/°C

Maximum Ratings

MAXIMUM SYSTEM VOLTAGE	1000V (IEC); 600V (UL)
SERIES FUSE RATING	15A
MAXIMUM REVERSE CURRENT	Series fuse rating multiplied by 1.35

MECHANICAL CHARACTERISTICS

DIMENSIONS	1652mm x 1000mm x 45mm (65.04 in x 39.37 in x 1.77 in)
WEIGHT	21kg (46.2 lbs)
FRAME	Aluminum alloy
FRONT	Tempered glass
ENCAPSULANT	EVA
BACK COVER	Composite sheet
CELL TECHNOLOGY	Polycrystalline
CELL SIZE	156mm x 156mm (6.14 in x 6.14 in)
NUMBER OF CELLS (Pieces)	60 (6 x 10)
JUNCTION BOX	Protection class IP65 with bypass-diode
OUTPUT CABLES	Solar cable: 4mm ² ; length 900mm (35.4 in)
CONNECTOR	Linyang LY0706-2

SYSTEM DESIGN

OPERATING TEMPERATURE	-40°C to 85°C
HAIL SAFETY IMPACT VELOCITY	25mm at 23m/s
FIRE SAFETY CLASSIFICATION	Class C
STATIC LOAD WIND/SNOW	5.4kN/m ²

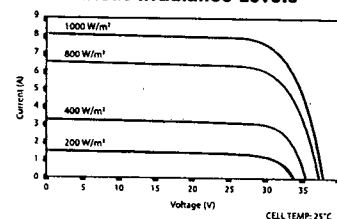
PACKAGING AND STORAGE

STORAGE TEMPERATURE	-40°C to 85°C
PACKAGING CONFIGURATION	22 pcs per pallet
LOADING CAPACITY (40 FT. CONTAINER)	572 pieces

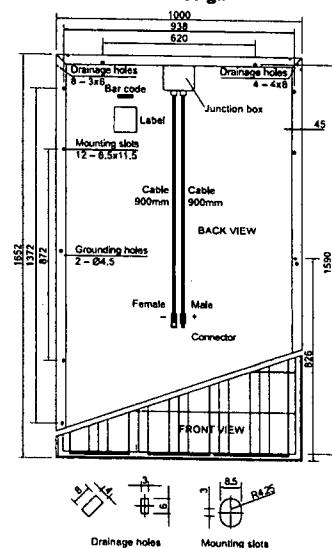
Performance at Low Irradiance:

The typical relative change in module efficiency at an irradiance of 200W/m² in relation to 1000W/m² (both at 25°C and AM 1.5G spectrum) is less than 5%.

Various Irradiance Levels



Basic Design



©Hanwha SolarOne Co., Ltd. Specifications are subject to change without notice. Revised: 2011-01-17

 Hanwha SolarOne

www.hanwha-solarone.com

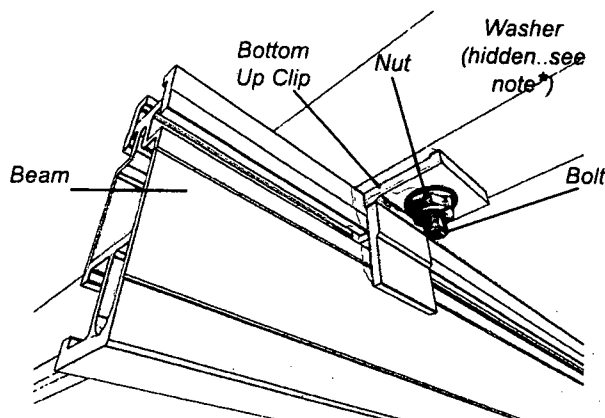
SolarMount Technical Datasheet

Pub 100602-1td V1.0 June 2010

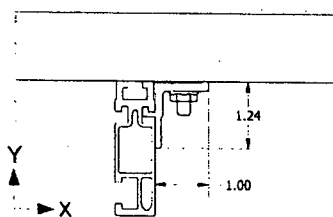
SolarMount Module Connection Hardware	1
Bottom Up Module Clip.....	1
Mid Clamp	2
End Clamp.....	2
SolarMount Beam Connection Hardware	3
L-Foot.....	3
SolarMount Beams	4

SolarMount Module Connection Hardware

SolarMount Bottom Up Module Clip Part No. 321001, 321002



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

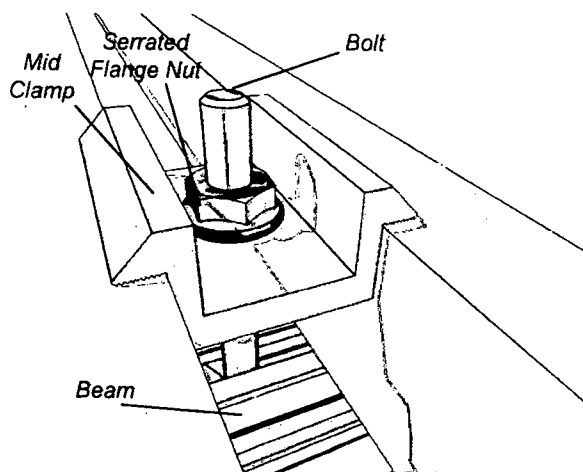


Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, ϕ
Tension, Y+	1566 (6967)	686 (3052)	2.28	1038 (4615)	0.662
Transverse, X±	1128 (5019)	329 (1463)	3.43	497 (2213)	0.441
Sliding, Z±	66 (292)	27 (119)	2.44	41 (181)	0.619

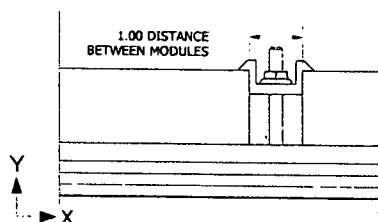
Dimensions specified in inches unless noted

SolarMount Mid Clamp

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



- **Mid clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **Mid clamp weight:** 0.050 lbs (23g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single mid clamp assembly when used with a SolarMount series beam to retain a module in the direction indicated
- Assemble mid clamp with one Unirac ¼"-20 T-bolt and one ¼"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory

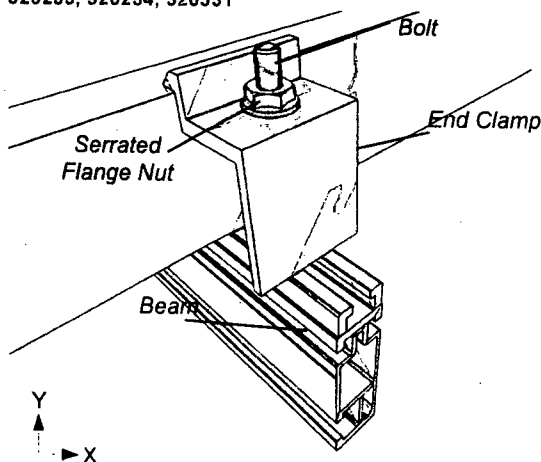


Dimensions specified in inches unless noted

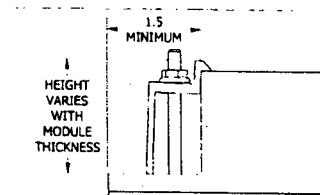
Applied Load Direction	Average Ultimate lbs (N)	Allowable Load lbs (N)	Safety Factor, FS	Design Load lbs (N)	Resistance Factor, ϕ
Tension, Y+	2020 (8987)	891 (3963)	2.27	1348 (5994)	0.667
Transverse, Z±	520 (2313)	229 (1017)	2.27	346 (1539)	0.665
Sliding, X±	1194 (5312)	490 (2179)	2.44	741 (3295)	0.620

SolarMount End Clamp

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



- **End clamp material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **End clamp weight:** varies based on height: ~0.058 lbs (26g)
- Allowable and design loads are valid when components are assembled according to authorized UNIRAC documents
- Values represent the allowable and design load capacity of a single end clamp assembly when used with a SolarMount series beam to retain a module in the direction indicated
- Assemble with one Unirac ¼"-20 T-bolt and one ¼"-20 ASTM F594 serrated flange nut
- Use anti-seize and tighten to 10 ft-lbs of torque
- Resistance factors and safety factors are determined according to part 1 section 9 of the 2005 Aluminum Design Manual and third-party test results from an IAS accredited laboratory
- Modules must be installed at least 1.5 in from either end of a beam



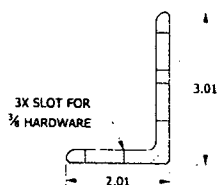
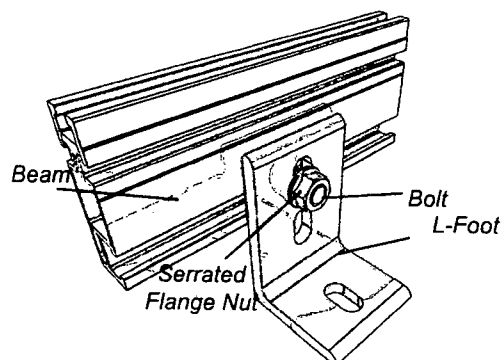
Dimensions specified in inches unless noted

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

SolarMount Beam Connection Hardware

SolarMount L-Foot

Part No. 310065, 310066, 310067, 310068



Dimensions specified in inches unless noted

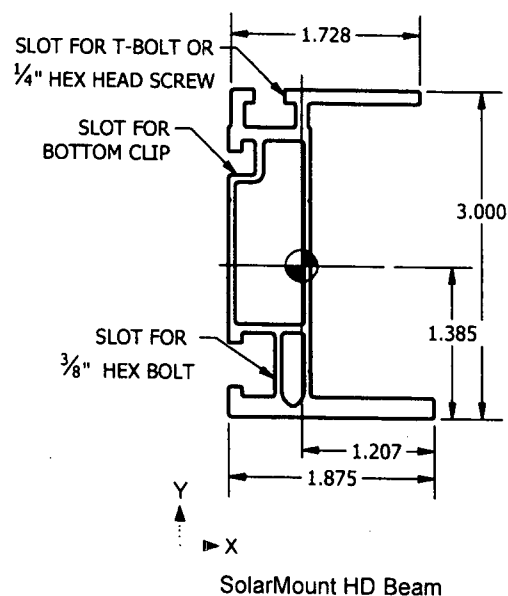
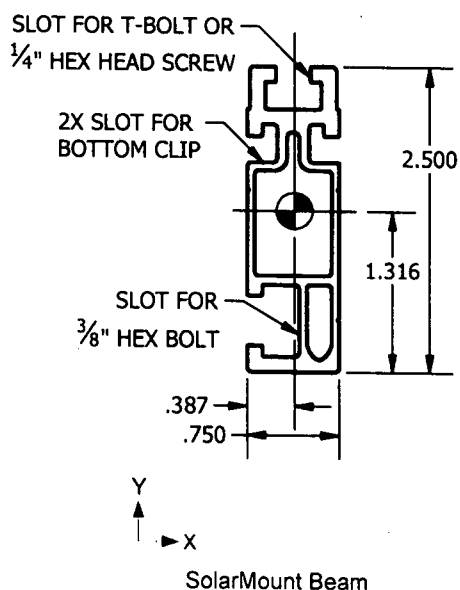
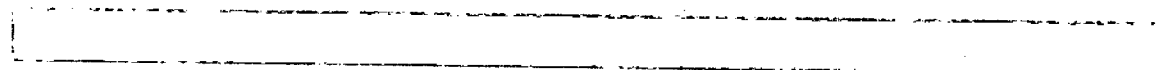
- **L-Foot material:** One of the following extruded aluminum alloys: 6005-T5, 6105-T5, 6061-T6
- **Ultimate tensile:** 38ksi, Yield: 35 ksi
- **Finish:** Clear or Dark Anodized
- **L-Foot weight:** varies based on height: ~0.215 lbs (98g)
- Allowable and design loads are valid when components are assembled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

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

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

SolarMount Beams

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



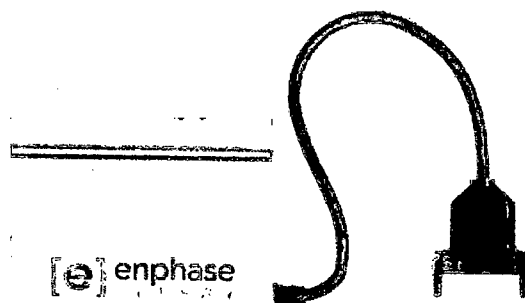
Dimensions specified in inches unless noted

M215 Microinverter Installation Planning

The Enphase M215 Microinverter

The M215 Microinverter is Enphase's most powerful and efficient model yet. This grid-tied microinverter is compatible with most 60-cell PV modules (up to 260W) and installs quickly and easily. It works with both three-phase 208 Vac or single-phase 240 Vac services in North America; voltage is determined by cable type.

For detailed installation information, refer to the **M215 Installation and Operations Manual** and the **M215 Quick Install Guide** at <http://www.enphase.com/support/downloads>.



Microinverter Compatibility

The M215 should be paired only with a 60-cell PV module. Refer to the Enphase website (<http://www.enphase.com/support/downloads>) for a list of **electrically**-compatible PV modules and approved PV module racking systems.

To ensure **mechanical** compatibility, be sure to order the correct Module Connector Type for both microinverter and PV module from your distributor.

Model Number	Electrical Compatibility	Module Connector Type
M215-60-2LL-S22 M215-60-2LL-S22-NA	60 cell PV module	MC-4 Type 2 Locking or Amphenol H4 Locking
M215-60-2LL-S23 M215-60-2LL-S23-NA	60 cell PV module	Tyco Solarlock Locking*

***Note:** Tyco connectors on PV modules can vary in polarity, and either the male or female connector may be positive. Only the MALE positive will mate with Enphase Microinverters with S23 connectors. Be sure to order the correct connector type for both microinverter and PV module from your distributor.

As a rule, the electrically-positive output of the PV module always connects to the positive input of the microinverter. However, PV modules come with a variety of labels. For more information, refer to **Mating Microinverters with PV Modules for Correct Polarity** under the Enphase downloads at <http://www.enphase.com/support/downloads>.

Branch Circuit Capacity

Do not exceed the maximum number of microinverters in an AC branch circuit as listed in the following table. You must protect each microinverter AC branch circuit with a 20A maximum breaker.

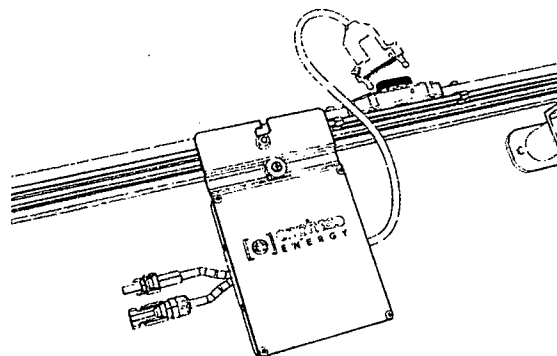
Maximum number of M215s per 20 amp AC Branch Circuit	
Service type	Max M215s per AC branch
240V	17
208V	25

Enphase Engage Cabling System

The M215 incorporates DC connectors and an AC connector. There is no integral AC cable on the M215. The Enphase Cabling System accomplishes the AC connection.

The Cabling System is a continuous length of 12 AWG, outdoor rated cable, with integrated connectors for microinverters. These connectors are preinstalled along the entire cable and spaced to accommodate both portrait and landscape PV module orientations.

The cable is installed by simply rolling out the desired length of cable and cutting it to size. One end is wired directly into the junction box at the head of the branch circuit, eliminating the need for a separate AC interconnect cable. The other end is sealed from the environment using an Enphase Branch Terminator. The M215 AC cable connectors are then plugged into the regularly-spaced connectors as shown.

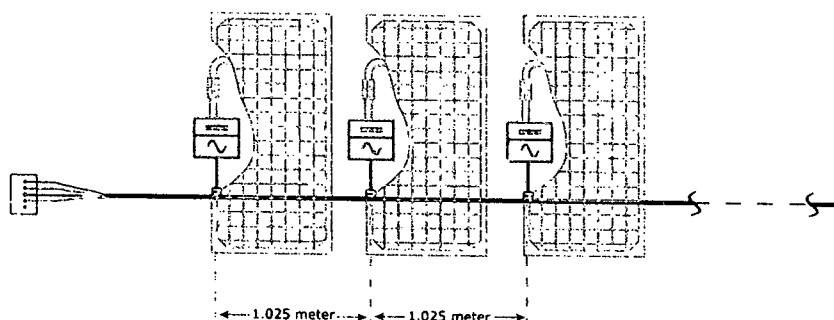


The Enphase Cabling System is available in two connector spacing options and two voltage types. Depending upon installer needs, the cabling is also available in a variety of lengths.

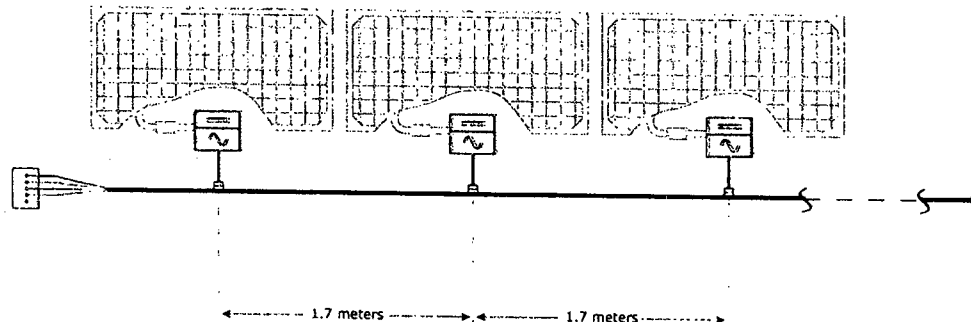
Connector Spacing Options

The gap between connectors on the cable can be either 1.025 meters (40") or 1.7 meters (67"). The 1.025 meter spacing is best suited for connecting PV modules installed in portrait mode, while the 1.7 meter gap is best suited to PV modules installed in landscape mode.

Cabling with drop connectors spaced at 1.025 meter (40") for portrait installs

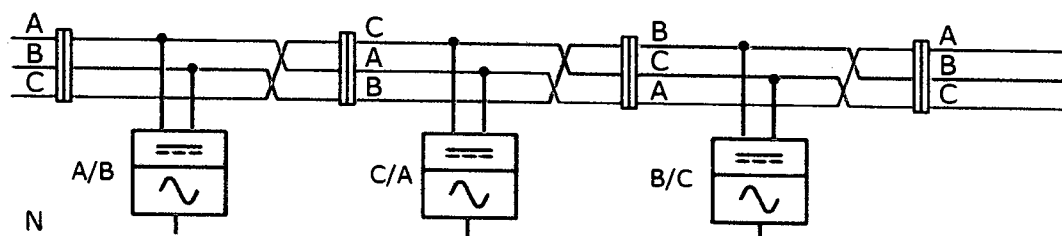


Cabling with drop connectors spaced at 1.7 meters (67") for landscape installs



Voltage Types and Conductor Count

The voltage types are either 240VAC split phase or 208VAC three phase. **All cable connectors bear labels indicating their cable voltage designation.** Typically used for residential applications, 240VAC includes four conductors. This cabling should also be used for split phase 208VAC applications. Three-phase 208VAC cabling includes five conductors, and is used for most commercial installations. Because Enphase microinverters output onto two phases, three phase cabling balances the phases by rotating conductor use from one microinverter to the next as shown in the following diagram. In the diagram, the three phases are labeled A, B, and C.



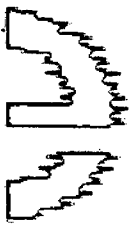
Racking Compatibility

Engage Cabling is compatible with a variety of racking systems. For a list of approved PV module racking types, refer to the Racking Compatibility document at (<http://www.enphase.com/support/downloads>).

Cabling Length Options

Engage Cabling is available in shorter lengths with 30-40 connectors, depending upon voltage type. Longer lengths can be ordered and cut to suit per order. Ordering options include:

Model Number	Voltage type/ conductor #	Connector count	Connector spacing	PV module orientation	Approx. weight
ET10-240-40	240VAC, 4 conductor	40 connectors	1.025 m (40")	Portrait	18.1 kg (40 lbs)
ET17-240-40	240VAC, 4 conductor	40 connectors	1.7 m (67")	Landscape	20.4 kg (45 lbs)
ET10-208-30	208VAC, 5 conductor	30 connectors	1.025 m (40")	Portrait	13.6 kg (30 lbs)
ET17-208-30	208VAC, 5 conductor	30 connectors	1.7 m (67")	Landscape	15.9 kg (35 lbs)
ET10-240-BULK	240VAC, 4 conductor	240 connectors	1.025 m (40")	Portrait	over 90 kg (200 lbs)
ET17-240-BULK	240VAC, 4 conductor	240 connectors	1.7 m (67")	Landscape	over 90 kg (200 lbs)
ET10-208-BULK	208VAC, 5 conductor	240 connectors	1.025 m (40")	Portrait	over 90 kg (200 lbs)
ET17-208-BULK	208VAC, 5 conductor	240 connectors	1.7 m (67")	Landscape	over 90 kg (200 lbs)



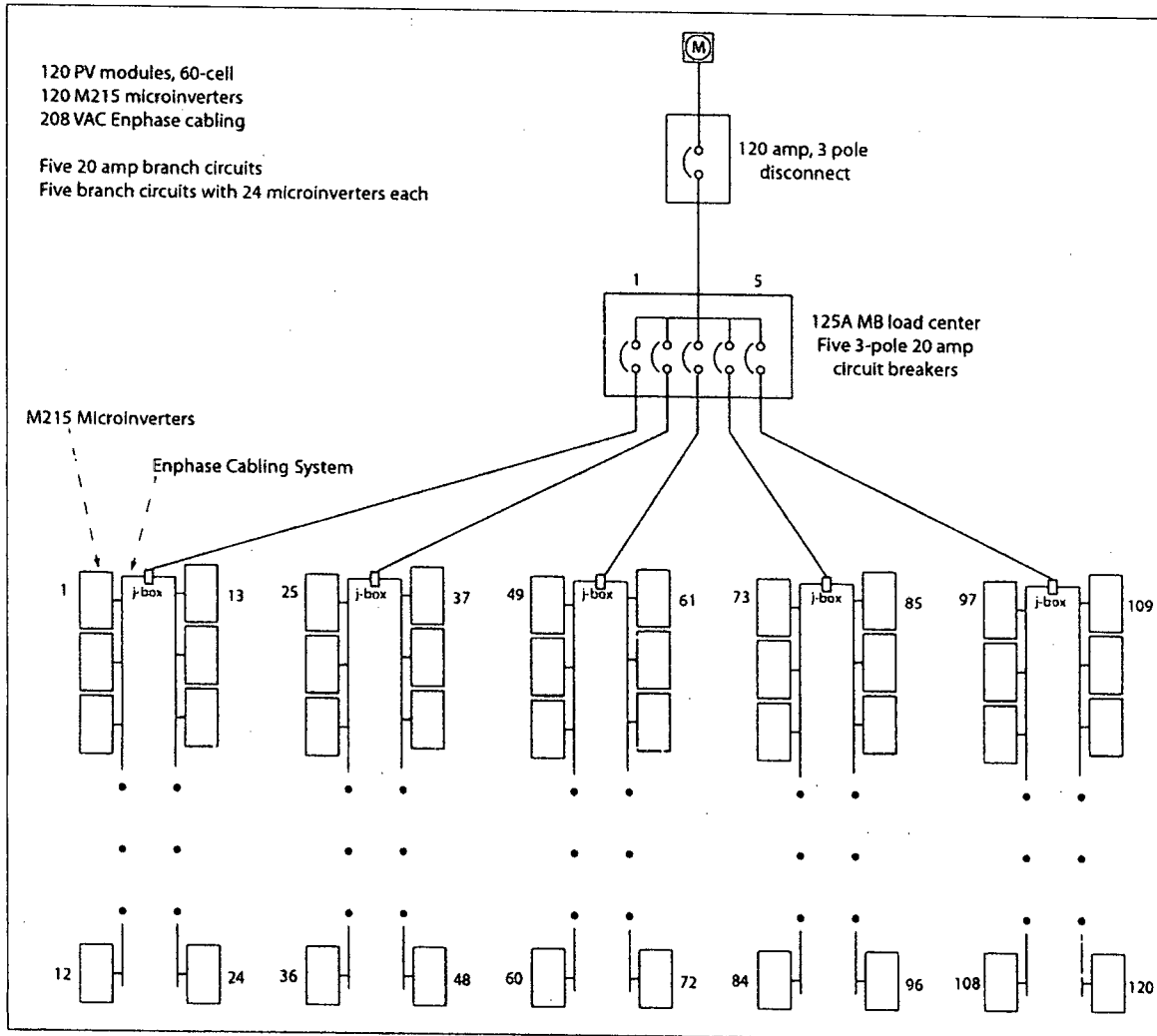
Planning for Cable Lengths and Type

The Cabling System is flexible enough to adapt to almost any solar design. To determine the length and cable type that you need, take into account the following considerations:

- **The number of Enphase Microinverters to be installed on the AC branch.** Be certain to allocate the correct number of connectors, including extra connectors for gaps and turns.
- **Additional length required to reach from the AC branch circuit junction box to the first microinverter.** If greater than half a connector cable interval is needed, it may be necessary to include one (or more) unused connectors in order to span this distance. Unused connectors must be covered with Enphase watertight sealing caps.
- **Additional length required to reach from one row of PV modules to the next.** If the PV modules are laid out in multiple rows, the distance from one row to the next often requires additional cabling length.
- **Bend radius.** When planning cabling turns or loops, you must account for a minimum bend radius of 6.7 cm (2.625").
- **Multiple sub-arrays.** Often, the AC branch circuit may be composed of several smaller sub-arrays across more than one roof plane. In this case, the cable is cut to service each smaller array, and the sub-arrays are connected together using appropriately rated runs of conduit. The transition from cable to conduit is accomplished using an outdoor rated junction box, as required by the NEC and local code. Unused connectors must be covered with Enphase watertight sealing caps.
- **Mixture of PV modules in both portrait and landscape installation.** Often, PV installations use modules installed in mixed orientation (both portrait and landscape mode). In this case there are three choices for cabling:
 1. Cabling with 1.025 meter spacing between connectors results in cleanest install for the modules in portrait mode. For modules placed in landscape mode, plan for an unused connector between each PV module to achieve the required additional distance. Unused connectors must be covered with Enphase watertight sealing caps.
 2. Cabling with 1.7 meter spacing between connectors results in cleanest install for the modules in landscape mode, but requires that any additional cable length between PV modules in portrait mode be coiled and dressed so that cabling does not contact the roof. Again, unused connectors must be covered with Enphase watertight sealing caps.
 3. Another solution when modules are installed in mixed orientation is to transition between 1.025 and 1.7 meter spacing cable options using an outdoor rated junction box. This junction box can be installed to the PV module railing.

Example Installation Layout and Parts Needed

The following installation diagram shows an example with five branches. The 208V layout shows five center-fed branches with 24 microinverters each. The PV modules are in landscape orientation. Tables following the diagram list required and optional equipment.



Enphase Items Required

Quantity	Description	Order Number
120	M215 Microinverter	M215-60-2LL-S22 or M215-60-2LL-S23
3 packs	Cable clips (each pack contains 100 clips)	ET-CLIP-100
1 pack	Disconnect tool (each pack contains five tools)	ET-DISC-05
1 pack	Branch Terminator (each pack contains 10 terminators)	ET-TERM-10
1	Enphase cabling divided into ten lengths: Each length should be about 20.4 meters (67 feet) with 12 connectors.	ET17-208-BULK
1 pack	Watertight sealing caps (Each pack contains 10). Required only if there are any unused connectors; Unused connectors must be covered with this cap.	ET-SEAL-10
1	Envoy Communications Gateway -or- LCF Envoy (Line Communications Filter) ¹	IEMU-03 ELCF-120-001

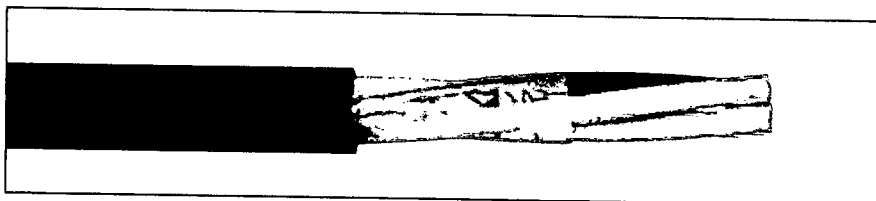
Non-Enphase Items Required

Quantity	Description
120	60-cell PV module
5	Weather-proof (NEMA) junction box
5	Three-pole 20 amp circuit breaker
1	Three-pole 120 amp circuit breaker
1	125 amp load center
1	Lightning protection device (3-phase AC surge protector)
as needed	Homerun conductors
as needed	Continuous grounding conductor or WEEB
as needed	Torque wrench, sockets, wrenches for mounting hardware
as needed	Adjustable wrench or open-ended wrench (for terminator caps)
as needed	Inspection mirror (for viewing indicator lights on the undersides of the microinverters)

¹ An LCF Envoy may be required for systems that are 30kW in size or larger.

FREP®

FR-EPR/CPE, Control, Unshielded
600V, UL Type TC-ER¹—E-2 Color Code



CATALOG NUMBER	NO. OF COND.	COND. SIZE (AWG)	COND. STRAND	MINIMUM AVG. INSULATION THICKNESS		MINIMUM AVG. JACKET THICKNESS		NOMINAL CABLE O.D.		COPPER WEIGHT		NET WEIGHT	
				INCHES	mm	INCHES	mm	INCHES	mm	lbs/ 1000ft	kg/km	lbs/ 1000ft	k

14 AWG MULTI CONDUCTORS

279560	2 Flat	14	7/0.242	0.030	0.76	0.045	1.14	.365x.230	9.3x5.8	26	38	61	91
305320*	2	14	7/0.242	0.030	0.76	0.045	1.14	0.370	9.40	26	39	71	106
280180	3	14	7/0.242	0.030	0.76	0.045	1.14	0.390	9.91	39	59	92	137
280190	4	14	7/0.242	0.030	0.76	0.045	1.14	0.425	10.80	53	78	115	171
279870	5	14	7/0.242	0.030	0.76	0.045	1.14	0.465	11.81	66	98	139	207
280200	7	14	7/0.242	0.030	0.76	0.045	1.14	0.505	12.83	92	137	173	257
280210	9	14	7/0.242	0.030	0.76	0.060	1.52	0.620	15.75	118	176	240	357
279880	12	14	7/0.242	0.030	0.76	0.060	1.52	0.700	17.78	158	235	301	448
279580*	19	14	7/0.242	0.030	0.76	0.060	1.52	0.815	20.70	250	372	468	696
279590	25	14	7/0.242	0.030	0.76	0.080	2.03	0.935	23.75	323	481	624	929
347080*	30	14	7/0.242	0.030	0.76	0.080	2.03	1.030	26.16	387	576	747	1112
279600*	37	14	7/0.242	0.030	0.76	0.080	2.03	1.110	28.19	466	694	875	1302

12 AWG MULTI CONDUCTORS

279840	2 Flat	12	7/0.305	0.030	0.76	0.045	1.14	.400x.245	10.2x6.2	40	60	82	122
307690*	2	12	7/0.305	0.030	0.76	0.045	1.14	0.410	10.41	41	61	94	140
280170	3+ Gnd	12	7/0.305	0.030	0.76	0.045	1.14	0.410	10.41	85	127	148	220
280300	3	12	7/0.305	0.030	0.76	0.045	1.14	0.435	11.05	64	95	124	185
280310	4	12	7/0.305	0.030	0.76	0.045	1.14	0.475	12.07	85	127	157	234
280320	5	12	7/0.305	0.030	0.76	0.045	1.14	0.520	13.21	106	158	191	284
279890	7	12	7/0.305	0.030	0.76	0.060	1.52	0.595	15.11	149	221	268	399
280330	9	12	7/0.305	0.030	0.76	0.060	1.52	0.695	17.65	191	285	337	502
280340	12	12	7/0.305	0.030	0.76	0.060	1.52	0.765	19.43	247	368	428	637
279610	19	12	7/0.305	0.030	0.76	0.080	2.03	0.940	23.88	391	582	688	1024
295400*	25	12	7/0.305	0.030	0.76	0.080	2.03	1.095	27.81	515	767	854	1271
347100*	30	12	7/0.305	0.030	0.76	0.080	2.03	1.150	29.21	618	920	1002	1491
301870	37	12	7/0.305	0.030	0.76	0.080	2.03	1.240	31.50	762	1134	1240	1845

10 AWG MULTI CONDUCTORS

279570	2 Flat	10	7/0.385	0.030	0.76	0.045	1.14	.445x.270	11.3x6.9	64	95	113	168
305340*	2	10	7/0.385	0.030	0.76	0.045	1.14	0.455	11.56	65	97	128	190
279680	3+ Gnd	10	7/0.385	0.030	0.76	0.045	1.14	0.485	12.32	134	199	225	335
280410	3	10	7/0.385	0.030	0.76	0.045	1.14	0.485	12.32	100	150	172	256
279900	4	10	7/0.385	0.030	0.76	0.060	1.52	0.560	14.22	134	199	234	348
279620	5	10	7/0.385	0.030	0.76	0.060	1.52	0.615	15.62	167	249	284	423
279630	7	10	7/0.385	0.030	0.76	0.060	1.52	0.670	17.02	234	349	381	567
279640	9	10	7/0.385	0.030	0.76	0.060	1.52	0.760	19.30	295	440	464	691
279650	12	10	7/0.385	0.030	0.76	0.080	2.03	0.905	22.99	402	598	651	969

Dimensions and weights are nominal; subject to industry tolerances.

*Non-stock item, minimum runs apply. Please consult Customer Service for price and delivery.

¹Approved as TYPE TC-ER for Exposed Run applications of 3 or more conductors as defined by NEC.

Product Construction

Conductor:

- 14 AWG thru 10 AWG fully annealed stranded tinned copper per ASTM B33
- Class B stranding per ASTM B8

Insulation:

- Flame-retardant Ethylene Propylene Rubber (FR-EPR) Type II
- Color-coded: per ICEA Method 1; Table E-2 (Does not include white or green)

Jacket:

- Flame-retardant thermoplastic Chlorinated Polyethylene (CPE)

Print

- GENERAL CABLE® (WC) FREP® XX/C XXAWG EPR/CPE (UL) TYPE TC-ER¹ XHHW-2 CDRS 90°C WET OR DRY 600V DIR BUR SUN RES DAY/MONTH/YEAR OF MFG SEQUENTIAL FOOTAGE MARK

Options:

- 2kV version
- Bare copper conductor.
- Class C stranding
- E-1 Color Code—See Spec 4310
- Overall shielded multi conductor
- Flame-retardant Cross-Linked Polyethylene (FR-XLPE) insulation
- Thermoplastic Low-Smoke, Zero-Halogen (LSZH) jacket
- Other constructions available upon request

Applications:

- In free air, raceways or direct burial
- In wet or dry locations
- Permitted for Exposed Run 'ER' use in accordance with NEC for 3 or more conductors
- Approved for direct burial, Class I, Div. 2 industrial hazardous locations per NEC

Features:

- Rated at 90°C wet or dry
- Ripcord applied to all cables with jacket thickness of 60 mils or less
- Excellent physical, thermal and electrical properties
- Sunlight- and weather-resistant
- Excellent moisture resistance
- Excellent resistance to compression cuts and heat deformation
- Low coefficient of friction for easy pulling
- Excellent flame resistance—burns to ash; does not exhibit thermoplastic drip
- Excellent low temperature cold bend characteristics
- Meets cold bend test at -40°C
- Meets the crush and impact requirements of Type MC cable for 3 or more conductors

Compliance:

- **Industry Compliance:**
 - UL 44 Type XHHW-2
 - UL 1277 Type TC-ER for 3 or more conductors
 - UL 1581
 - ICEA S-73-532

Flame Tests Compliance:

- UL 1581 VW-1
- UL 1277
- IEEE 383
- IEEE 1202
- CSA FT-4
- ICEA T-29-520

Other Compliance:

- EPA 40 CFR, Part 261 for leachable lead content per TCLP
- OSHA acceptable

Packaging:

- Material cut to length and shipped on non-returnable wood reels



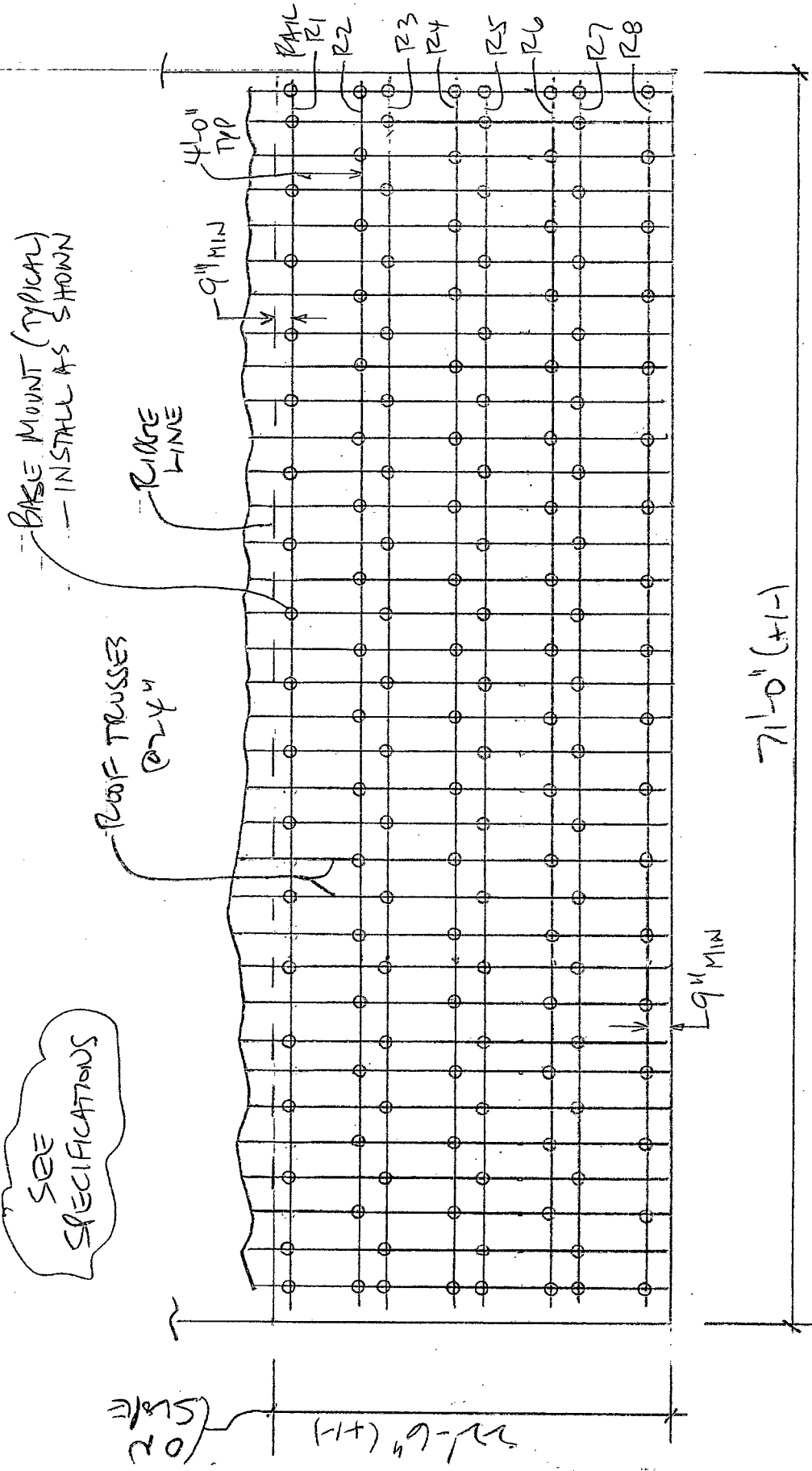
General Cable

Phone: 888-593-3355
www.generalcable.com

John F. Mann, PE
GER 9049

1669 ROUTE 88
BRICK NJ

SEE
SPECIFICATIONS



PLAN OF RAFTERS & BASE MOUNTS - PA1 (84 PAGES)
1/8" = 1'-0"

Roof Support Requirements
For Proposed Solar Panels

Certification & Background Information

Certifications

Engineer has performed limited structural evaluation of existing roof framing and proposed rail-support system to support solar panels, based on available information.

Engineer provides the following certifications, subject to conditions of these specifications;

- ☒ Roof trusses have adequate capacity to support proposed solar panel installation, with reinforcing as may be specified.
- ☒ Design forces (based on code provisions for new construction) applied to the support components (rails, mounts), by solar panel arrays, do not exceed design capacities published in the referenced test report.
- ☒ Proposed rails are expected to have adequate capacity to resist design loads. However, manufacturer must provide written certification due to lack of complete load capacity information, including lateral force (parallel to roof surface).

Summary of Conditions

This entire specification must be read to completely understand all conditions.

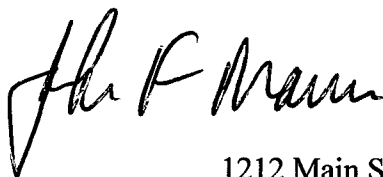
Certification is based on the following specific conditions;

1. Rails shall be located to avoid installation of lag screws into any part of the truss top chord where risk of splitting is relatively high.

The following general conditions apply;

- GC1. Truss members shall have lateral bracing at locations specified on truss design diagrams (by truss manufacturer) or as specified by professional engineer (working for owner) based on detailed structural analysis of as-built trusses.
- GC2. Verify that roof framing members to support solar panels are in good condition, without obvious damage. Repair any damage per specifications, or consult engineer.
- GC3. Verify all dimensions shown on plans.
- GC4. Base mounts shall be offset (staggered) as shown on plans.
- GC5. Lag screws for base mounts shall be installed into center of roof framing members. Any damage caused to roof framing members shall be properly repaired.

John F Mann, PE
GE29049



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Belmar NJ 07719

Roof Support Requirements
For Proposed Solar Panels

Background Information

Information about existing roof framing and building conditions has been obtained from contractor.

These specifications are based on the following information provided by contractor;

- ☒ Description of solar panel requirements
- ☒ Basic details of roof framing (member sizes, arrangement) to support solar panels
- ☒ Photos of roof framing (from inside attic space) to support solar panels

Specifications are also based on the following reference information;

- ☒ Product information for solar panels (SF220 230W by Hanwha Solar One)
- ☒ SolarMount Code-Compliant Installation Manual 227.3 by Unirac
- ☒ SolarMount Technical Data Sheet, Pub 100602-1td V1.0 June 2010, by Unirac

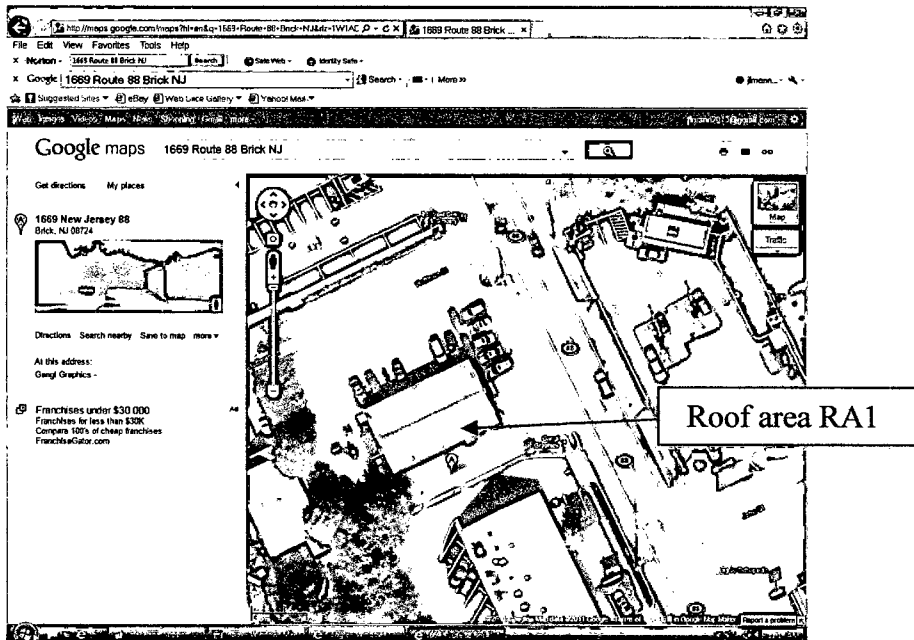
Roof Support Requirements
For Proposed Solar Panels

Description of Building

Existing one-story wood-framed building is used for business.

Front wall, facing street, is considered the north wall. Directions right and left are taken as looking at back (south) wall from outside.

Aerial view of building can be seen by clicking "Satellite" on Google map and zooming in.



Roof Configuration; General Description

Configuration of is a symmetrical gable with ridge parallel to front wall.

The following roof areas are defined for this discussion;

RA1 Back slope of main gable roof

Slope of roof area RA1 is estimated to be 4 vertical to 12 horizontal.

Roof Support Requirements
For Proposed Solar Panels

General Arrangement of Solar Panels

One array / group of solar panels (PA1 shall be installed on the following roof areas;

<u>Panel Array</u>	<u>Roof Area</u>
PA1	RA1

Dimensions of each solar panel (SF 220 230W by Hanwha Solar One) are 39.37 inches wide by 65.04 inches long. In general, the long dimension of panels may be set parallel or perpendicular to roof framing members, to allow for maximum number of panels. Panel setup (orientation) designation is as follows;

PS-Long	Long dimension parallel to roof framing members
PS-Short	Short dimension parallel to roof framing members

Each row of panels is to be supported by two (2) rails, with basic spacing (along slope) of 4'-0" (PS-Long) or 2'-8" (PS-Short). Rail spacing may be reduced to minimum of 3'-6" (PS-Long) or 2'-2" (PS-Short) if required to clear obstructions and with approval of panel manufacturer.

- ☒ If rail spacing is to be less than minimum basic spacing (3'-6" or 2'-2"), contractor shall verify that rail spacing is approved by the solar panel manufacturer.

Arrangement of rails and base mounts is shown on "Plan of Rails & Base Mounts" for each panel array as follows;

PA1	PS-Long	84 panels	(4 rows of 21 each; maximum)
-----	---------	-----------	------------------------------

Number of panels installed may be more or less, depending on various factors including obstructions from elements such as existing chimneys, ventilators and vent pipes.

Roof Support Requirements
For Proposed Solar Panels

Roof Framing

Roof framing to support solar panels consists of prefabricated wood roof trusses, generally spaced at 24 inches. Per contractor, roof truss diagrams are not available from owner.

Contractor has provided digital photos of roof trusses to support solar panels (from inside attic space).

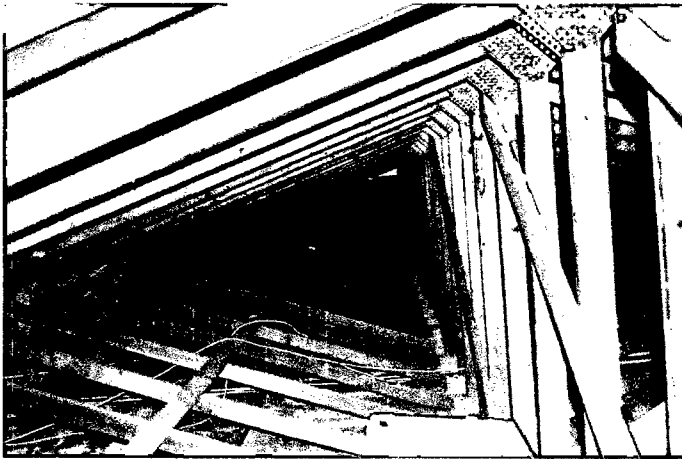


Photo 1 - Roof trusses. Lateral bracing across sloped webs.



Photo 2 - Sloped bracing across center verticals.

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Roof Support Requirements
For Proposed Solar Panels

Roofing & Roof Sheathing

Existing roofing consists of asphalt shingles.

Roof sheathing is plywood.

Any damaged roof sheathing should be reinforced from underneath, to prevent more severe damage during construction and to minimize risk of damage to roofing in the future that could be difficult to repair once solar panels are installed.

Effect of Solar Panels on Roof Framing

Weight of solar panels marginally increases total permanent ("dead") load that roof framing must support.

Weight of solar panels (about 3 pounds per square foot or less) is low compared to other loads that must be supported by roof framing. However, weight of panels is not applied evenly (uniformly) to the roof. Panels are supported by brackets or mounts that concentrate load on roof framing.

For a residential roof, the largest type of gravity (downward) load is generally snow load, as defined by the governing building code. When solar panels are installed, snow load (on solar panels) is distributed to the mounts and then to roof framing.

If mounts are not distributed evenly to roof framing members, total load on framing that must support mounts will be much greater compared to conditions without solar panels. Therefore, mounts must be offset (staggered) to distribute load from panels evenly to roof framing members.

Wind causes uplift pressure on a roof, with or without solar panels. Wind uplift pressure that would otherwise be applied to the roof surface is assumed to be applied to the surface of solar panels.

Similar to snow load, wind uplift pressure applied to solar panels is also distributed to mounts and then to roof framing. Secure connections are required to transfer wind uplift force from mounts to roof framing.

Roof Support Requirements
For Proposed Solar Panels

Evaluation of Existing Roof Framing

The only practical way to provide complete structural evaluation of roof trusses would be to obtain truss diagrams from the office of the construction official.

For projects in New Jersey, roof trusses are most often designed for 30 psf uniform snow load or greater. However, even if trusses were designed for snow load of 25 psf, load applied by solar panels (through base mounts) is not excessive, for the following reasons;

1. Per standard code provisions, required uniform snow load (on both slopes, simultaneously) is 13 psf, without taking into account reduction allowed for slippery roof surface (such as glass of solar panels). Minimum uniform live load is 16 psf.
2. Base mounts are to be distributed evenly on all roof trusses, so that total snow load applied to each truss remains effectively the same as current conditions.
3. Additional weight of solar panels (3 psf) is very low. Weight of permanent materials ("dead load") used for design of roof trusses typically allows for 2 psf additional.
4. Design capacity of prefabricated roof trusses is generally much greater than required for the design loads, which are conservative.

Key issue for any roof truss evaluation is whether or not web members must be braced.

In general, lateral bracing is required for long web members that must resist compression force due to gravity load (weight of roof and snow on roof) or wind uplift.

Line of 2x4 bracing has been installed on the long sloped web members (Photo 1).

Resistance To Wind Uplift

Resistance to wind uplift force is dependent on connections between roof framing members and top of support walls. There is no information about these connections. However, due to additional weight of solar panels, wind uplift forces at ends of roof framing members are expected to be less than wind uplift forces for existing conditions (without solar panels).

Roof Support Requirements
For Proposed Solar Panels

Connections; Base Mounts to Roof Framing

Design of connections between base mounts and roof framing members is based on the key assumption that wind uplift pressures on solar panels will be essentially the same as wind uplift pressures on the existing roof without solar panels.

Design Capacity of SolarMount Rails

Design capacity of SolarMount rails (also termed "beams" by Unirac) is determined by reference to the following;

- ☒ Table 8 (page 12) in SolarMount Installation Manual 227.3
- ☒ Table of rail properties (page 4) in SolarMount Data Sheet

Table 8 allows for rail selection based on span length and uniform loading.

Roof Support Requirements
For Proposed Solar Panels

Evaluation of SolarMount Rail Load Capacity per Installation Manual

Load capacity for SolarMount rails (per requirements of SolarMount Installation Manual) are not completely representative of actual installed conditions expected for the sloped roof, as noted below.

Verification of load capacity for SolarMount rails shall be provided by rail manufacturer (Unirac), as required by Conditions of Certification.

The following effects can be expected due to differences between conditions of product information (on level surface) and installed conditions (on sloped roof).

1. For sloped roof, uniform gravity load (such as weight of snow) applies lateral force to the rail (parallel to roof slope) in addition to "normal" force, which acts perpendicular to roof surface. These two load components result in biaxial bending of the rail.
2. Installed rails will be continuous over numerous supports.
3. Wind uplift pressure is variable (non-uniform).

For typical roof slopes, normal force (perpendicular to roof surface) and lateral force (parallel to roof surface) are listed below, as percent of vertically-acting gravity load.

<u>Slope</u> <u>Vert : Horz</u>	<u>Slope Angle</u> <u>From Horizontal</u>	<u>Normal</u> <u>Force</u>	<u>Lateral</u> <u>Force</u>
3 : 12	14.0 degrees	97	24
4 : 12	18.4 degrees	95	32
5 : 12	22.6 degrees	92	38
6 : 12	26.6 degrees	89	45
7 : 12	30.3 degrees	86	50
8 : 12	33.7 degrees	83	55
9 : 12	36.9 degrees	80	60
10 : 12	39.8 degrees	77	64
12 : 12	45.0 degrees	71	71

For the estimated 4 on 12 roof slope of RA1, normal force (perpendicular to roof surface) is 95 percent of gravity load. For maximum design snow load (unbalanced) of 20 psf, plus weight of solar panels (3 psf), linear design load on each rail is then 59 PLF.

When connected to each pair of rails, solar panels act like a structural plate element ("diaphragm"), tending to prevent lateral bending deflection of rails. Although there is no way to fully evaluate such effect without test data, solar panels acting as a diaphragm effectively eliminate much of the lateral force for the rails (though not for base mounts).

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Roof Support Requirements
For Proposed Solar Panels

Rail manufacturer provides design capacity only for loading perpendicular to strong axis of rails. Rail manufacturer claims that rails have adequate capacity for weak-axis load, parallel to roof slope. However, manufacturer does not publish weak axis design capacities for the proprietary section.

Engineer certifies only strong axis design capacity for rails.

Contractor or owner should consider submitting request for written verification that rails have design capacity to resist combined vertical and lateral design loads per these specifications.

L-Bracket Mounting System

Evaluation of the Unirac L-bracket ("L-foot") mounting system is based on information in the SolarMount Technical Data Sheet (page 3).

SolarMount rails are bolted directly to vertical leg of the L-bracket mounts.

Allowable load parallel to roof surface (perpendicular to rails) is the Tranverse force (misspelled Traverse by Unirac) in the table. For service load design (without load factors), the "Allowable Load" of 213 pounds is applicable.

Roof Support Requirements
For Proposed Solar Panels

Conditions of Certification

Contractor shall provide owner with these Specifications and any other drawings or documents provided by engineer, as referenced in these Specifications.

- ☒ Contractor shall make owner aware of any requirements that may be specified for the owner. Contractor shall make all such requirements a condition of the contract between contractor and owner, or shall take responsibility for making other arrangements to have others perform such requirements.

The following conditions of certification are described in these specifications;

1. Solar Panel System Design
2. Intent and Scope of Engineering Certification
3. Design Details
4. Prevention of Roof Leaks
5. SolarMount Rails & Mounts; Verification of Design Capacity
6. Evaluation of Existing Roof Framing For Wind Uplift
7. Support Requirements for Solar Panels
8. Additional Inspection & Reinforcement of Roof Framing
9. Design for Gravity Loads
10. Design for Wind Loads
11. Design Capacity of Lag Screws
12. Roof Sheathing
13. Roof Vent Pipes & Obstructions

1- Solar Panel System Design

Design of system configuration, including number and size of panels, electric supply and arrangement of various components, shall be provided by owner as required by the Construction Official.

Solar panels shall be installed on existing roof areas as shown on plans provided by contractor.

Design of solar panels, support rails, base mounts and other system components shall be responsibility of applicable manufacturer.

Roof Support Requirements
For Proposed Solar Panels

2- Intent and Scope of Engineering Certification

Engineering certification of roof framing does not include detailed structural analysis of the entire roof framing system or of building elements that support roof framing.

For this evaluation, "roof framing" is considered to consist of rafters only.

Intent and scope of certification is limited to the following;

- ☒ For roof framing to support solar panels, determine (by calculation) the following;
 1. Load capacity using provisions of building code for new construction, modified as appropriate, and conservative assumptions about material properties.
 2. Required load capacity based on; (1) Design loads specified by building code (for new construction), (2) Weight of solar panels and (3) Arrangement of solar panel support system (rails + base mounts) as required by these specifications and attached "Plan of Rails & Base Mounts". Snow load is considered to be applied to solar panels as if solar panels are the roof surface.
- ☒ If calculated load capacity is less than required capacity, develop requirements for remedial work to reinforce existing roof framing, if practically feasible. Otherwise, inform contractor that installation of solar panels is not recommended.
- ☒ Determine maximum base mount spacing (along panel support rail) based on rail design capacity (or test report information) provided by rail manufacturer. However, conditions to this certification may apply, especially if manufacturer has not provided design capacity for sloped roof conditions.
- ☒ Provide limited evaluation of existing roof framing conditions to determine if there are any major existing defects, such as decay damage (from water) or improper modifications (such as for skylights). Owner and contractor are responsible for detailed inspection of existing conditions.
- ☒ Determine requirements for connection of rail supports to roof framing to provide adequate capacity to resist wind uplift forces, based on code-specified wind pressures for new construction.

Roof Support Requirements
For Proposed Solar Panels

3- Design Details

The following design details are attached to these specifications;

1. Plan of Rails & Base Mounts – PA1

Contractor shall verify dimensions and conditions shown on Plan of Rails & Base Mounts, especially framing for dormers and skylights (if applicable for roof slope to support panels). Report significant differences for actual conditions to engineer to allow for evaluation, as appropriate.

- ☒ If actual sloped dimension of roof area is less than sloped dimension shown on plan, the number of solar panels may have to be reduced. Contractor shall verify dimensions before completing design of solar panel system.

4 – Prevention of Roof Leaks

Contractor and owner are completely responsible for design of methods used to prevent roof leaks.

Roof Support Requirements
For Proposed Solar Panels

5- SolarMount Rails & Mounts; Verification of Design Capacity

Unit design loads for rails are as follows;

Snow Load; Unbalanced condition	59 PLF	(Perpendicular to roof surface)
	20 PLF	(Parallel to roof surface)
Wind Uplift; Components & Cladding	98 PLF	(Perpendicular to roof surface; Rail R1)

For snow load, both design forces act simultaneously. Weight of solar panels has been included.

Wind uplift includes offset from weight of solar panels (taken as 2 psf).

- ☒ Based on Table 8 and analysis of rail stresses (using published design properties), standard rails have adequate capacity to resist design loads.

For rail support angle (L-foot) spaced at 4'-0", the following design forces and allowable loads are applicable;

	<u>Design Force</u>	<u>Allowable Load</u>	
Snow; perpendicular to roof surface	236 lbs	1,325 lbs	OK
Snow; parallel to roof surface	80 lbs	213 lbs	OK
Wind uplift	396 lbs	707 lbs	OK

See Section 11 for shear capacity of lag screw connecting base mount to roof framing.

Roof Support Requirements
For Proposed Solar Panels

6 - Evaluation of Existing Roof Framing For Wind Uplift

Roof framing must resist wind uplift pressure on roof (and solar panel) surfaces. Engineer has not evaluated capacity of connections between framing members and supports to resist code-specified wind uplift pressures.

If building design plans are available, plans could be reviewed to evaluate specified connections. However, some inspection would be required to verify that as-built connections were made as specified on plans.

The alternative would be to remove finish materials (and perhaps exterior wall sheathing) along each support to allow for inspection and evaluation.

7 - Support Requirements for Solar Panels

Installed weight of solar panel shall not exceed 3 psf over area of solar panel. Contractor shall supply certification of panel weight from manufacturer to owner and Construction Official.

Panels shall be supported on SolarMount aluminum rails manufactured by Unirac; see Installation Manual for complete details.

Connection of rails to roof must distribute the following forces to roof framing;

- ☒ Weight of solar panels
- ☒ Weight of snow on panels
- ☒ Wind uplift pressure applied to panels

A base mount (L-bracket or angle) supports rails directly. Base mount is connected to roof framing members using a single lag screw. Base mounts shall be located per general description in these specifications or per plan of base mounts if provided.

- ☒ If a plan of base mounts is attached, base mounts shall be located as shown on such plan, which takes precedence over general description in these specifications.

Each row of solar panels shall be supported on two rails running perpendicular (across) roof framing members.

Roof Support Requirements
For Proposed Solar Panels

Rails shall be connected to existing roof framing members as specified below;

1. For each rail, base mounts shall be installed above roof framing members at locations shown on plan of rails and base mounts.

General guidelines are as follows;

End of each rail may cantilever past the base mount a maximum of 16 inches or as specified by the rail system manufacturer, whichever is less.

Each Rail - End of rail + As shown Plan of Rails & Base Mounts

Except as shown on Plan of Rails & Base Mounts, base mounts on adjacent rails must be offset (staggered) so that the base mount for one rail is not on the same roof framing member as the base mount for the adjacent rail.

2. Owner and contractor are responsible for ensuring that base mount manufacturer has designed connections to be installed on existing roof such as to prevent roof leaks with proper installation. Owner and contractor are responsible for proper installation and all sealing necessary to prevent roof leaks. Owner shall submit any design details, showing how roofing is to be protected, that may be required by the Construction Official.
3. Each mounting assembly shall be connected to top of roof framing member using one lag screw; 5/16 inch diameter by 3- inch minimum.
4. Each lag screw must be installed as close as feasible to center of 1-1/2 inch thick roof joist. Minimum edge distance, from center of lag screw to edge of wood member, is 1/2 inch.
5. If roof framing member is not straight (bowing sideways), it may be necessary to install a ledger board up against the joist to provide sufficient solid wood for installing lag screws. Such ledger board shall be connected to the framing member with #8 wood screws spaced at 4 inches maximum. For nominal two inch thick ledger board up against nominal two inch thick framing member, screws shall be 3 inches long. Screws shall extend at least 1.25 inches into roof member. However, if roof member is bowing significantly, owner should also have additional engineering evaluation performed.

Roof Support Requirements
For Proposed Solar Panels

6. Any lag screws that split wood support member (rafter, roof joist, truss top chord) shall be removed. For minor splits, wood support members shall be reinforced with new, nominal two inch thick wood sections on each side. The mount shall be relocated so that a new lag screw is installed into new wood. Each section of new wood shall be at least 4 feet long, centered on the split location, and screwed to side of rafter with six (6) #8 wood screws.
7. Any major splits of wood framing members require more extensive repairs. Consult engineer for requirements.

8 – Additional Inspection & Reinforcement of Roof Framing

Contractor shall perform additional inspection as may be required to verify the assumed conditions (if any) listed for "Evaluation of Existing Roof Framing".

Contractor shall inspect underside of roof sheathing from inside attic space to determine extent of any damaged roof sheathing to be reinforced with new plywood between rafters. Install ledger boards (nailed to rafters) under edges of reinforcement sheathing. At vent pipe, install two strips of plywood, one on each side of pipe.

For any rafters with long or wide splits (especially splits through bottom edge of rafter), install reinforcement board (of same size as rafter) alongside, connected to rafter with wood screws (10 gage x 3 inch) spaced at 10 inches. High end of reinforcement shall extend to ridge board. Low end of reinforcement shall extend at least 3 feet past low end of the split or other damage, or as close as feasible to low end of rafter.

For any wide gaps between high end of rafter and ridge board, install light-gage steel joist hanger, using short 8d x 1-1/2 inch nails. As alternative to joist hanger, a reinforcement board (at least 3 feet long) may be installed, connected to rafter, with high end tight to ridge board. Connect reinforcement board to ridge board with light-gage steel A35 framing angle.

Roof Support Requirements
For Proposed Solar Panels

9 - Design for Gravity Loads

Design dead loads are based on actual weight of materials (if known) or standard assumed weights per building code provisions.

Weight of solar panels is per product data sheet provided by contractor.

Dead Load	5 psf (roofing + roof sheathing)
Weight of solar panels	3 psf

For determination of snow load, the roof slope to support solar panels has been considered part of a simple gable roof. Therefore, unbalanced snow load is applicable.

Design live loads listed below are based on applicable provisions of the UCC (Rehabilitation subcode) and building subcode (IRC 2009).

Ground Snow Load	20 psf (per UCC Bulletin 94-8)
Importance Factor	1.0 (ASCE 7-05; Table 7-4)
Exposure Factor, Ce	0.9
Thermal Factor, Ct	1.1
Sloped Roof Snow Load; uniform	13.9 psf (asphalt shingle surface) 11.9 psf (slippery glass surface)
Unbalanced Snow Load	
Leeward slope; uniform	11.9 psf (slippery glass surface)
Surcharge	13.8 psf
Length of surcharge	6.7 feet (heading down from ridge)
Minimum Live Load	16.0 psf (IRC 2009 NJ; Table R301.6)

Glass surface of solar panels qualifies as "slippery" per ASCE 7-05 (7.4), which reduces sloped roof snow load for balanced conditions, per code provisions.

However, for unbalanced snow loading, slippery roof surface does not decrease snow load unless horizontal length of slope (W; eave to ridge) is greater than 20 feet. For this house, maximum W (for PA1), about 22.5 feet, is large enough such that unbalanced snow load may be reduced for slippery surface.

1669 Route 88
Brick NJ
Ocean County

Specifications

August 23, 2011

Roof Support Requirements
For Proposed Solar Panels

10 - Design for Wind Loads

Basic Wind Speed (3-second gust)	115 mph (per UCC Bulletin 03-4)
Exposure Category	B
Mean Roof Height	20 feet

Wind uplift pressures (gross) on roof surface (solar panels) per ASCE 7-05 (Figure 6-3);

Roof Slope	18.4 degrees (RA1)
Effective Wind Area	10 sf
Adjustment Factor	1.00
Zone 1; C-C	21.8 psf
Zone 2; C-C	38.0 psf
Zone 3; C-C	58.2 psf

For further discussion, the term "row" is taken to be parallel with ridge. The term "column" is taken to be perpendicular to ridge.

Each pair of rails resists wind force from one row of solar panels (parallel to ridge).

Net uplift force is based on 2 psf for weight of panels, subtracted from gross uplift pressure.

Zone 2 uplift pressures are applicable within each "edge strip", which occurs along; (1) Each end of the roof, (2) Each side of ridge, (3) Each low edge (eave), and (4) Each side of any hip or valley line.

Zone 3 uplift pressures are applicable where edge strips overlap, generally at corners of each roof surface.

Width of each edge strip is per standard code provisions (minimum 3.0 feet).

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Roof Support Requirements
For Proposed Solar Panels

For calculating wind uplift forces on base mounts, the following conditions are defined;

Condition 1 – Tributary uplift pressures from Zone 1 only. This condition typically occurs only when an outer edge of the panel array is not within the edge strip, or when an array includes more than 4 rows of base mounts.

Condition 2A – Base mounts along ridge and eave subject to edge strip pressures. Tributary uplift pressure is typically from Zone 1 and Zone 2.

Condition 2B – Column of base mounts nearest to end of roof, if subject to edge strip pressures. Tributary pressure is typically from Zone 1 and Zone 2.

Condition 3 – Base mounts subject to Zone 3 pressure.

Net wind uplift forces to be resisted by base mounts are listed below for row of base mounts.

For each panel array, rails are designated from upper rail nearest to ridge (R1) to lower rail. Distance below ridge is approximate, along the roof slope.

Roof Support Requirements
For Proposed Solar Panels

Base Mount Uplift Forces (Lbs) – PA1 (84 panels)

Length of panels (along slope) = 21'-8" (4 @ 5'-5")

Rail spacing (along slope) = 4'-0" (4 rows; 8 rails)

Length of roof slope = 22'-6" (to be verified)

Ridge to rail R1 = 0'-9"

Base mount spacing; (along rail, for calculation purposes only)

Rails R1 - R8 = 48 inches (maximum)

** Not Applicable

Rail	Below Ridge	Distance	Condition	Condition	Condition	Condition
		1	2A	2B	3	
R1	0.70 ft	**	385	**	461	
R2	4.75 ft	**	281	356	**	
R3	6.17 ft	215	**	290	**	
R4	10.17 ft	215	**	290	**	
R5	11.59 ft	215	**	290	**	
R6	15.59 ft	215	**	290	**	
R7	17.01 ft	**	238	313	**	
R8	21.01 ft	**	331	**	406	

☒ For each rail, maximum net uplift force (base mounts) is less than design pullout capacity (512 lbs) for specified lag screws (5/16" dia; 3-inch minimum length for Unirac L-bracket).

☒ For each panel array, required base mount spacing is specified on Plan of Rails & Base Mounts. Specified base mount spacing may be less than the maximum spacing listed above to ensure proper distribution of load to roof framing members.

11 – Design Capacity of Lag Screws

Design capacity of lag screws (5/16-inch) is based on the following conditions;

- ☒ Rafter is Spruce-Pine-Fir (SPF) or Hem-Fir wood
- ☒ Standard lag screw thread configuration and steel properties per ANSI B18.2.1
- ☒ Penetration of lag screw thread into wood rafter is at least 1.75 inches
- ☒ Lag screw installed into center of rafter thickness. Edge distance of 1/2-inch minimum.
- ☒ Load Duration Factor for wind (per NDS-05) = 1.6

Design pullout capacity of lag screw = 512 lbs

For increased penetration into rafter (such as for longer lag screw), pullout capacity is greater.

12 - Roof Sheathing

Roof sheathing shall be in good condition, without any obvious damage or decay.

Roof sheathing must have adequate connection to roof framing members to ensure that framing members have proper lateral bracing.

Contractor shall inspect roof sheathing from inside the attic space.

For roof sheathing that will be under proposed solar panels, any damage shall be repaired prior to installation of panels.

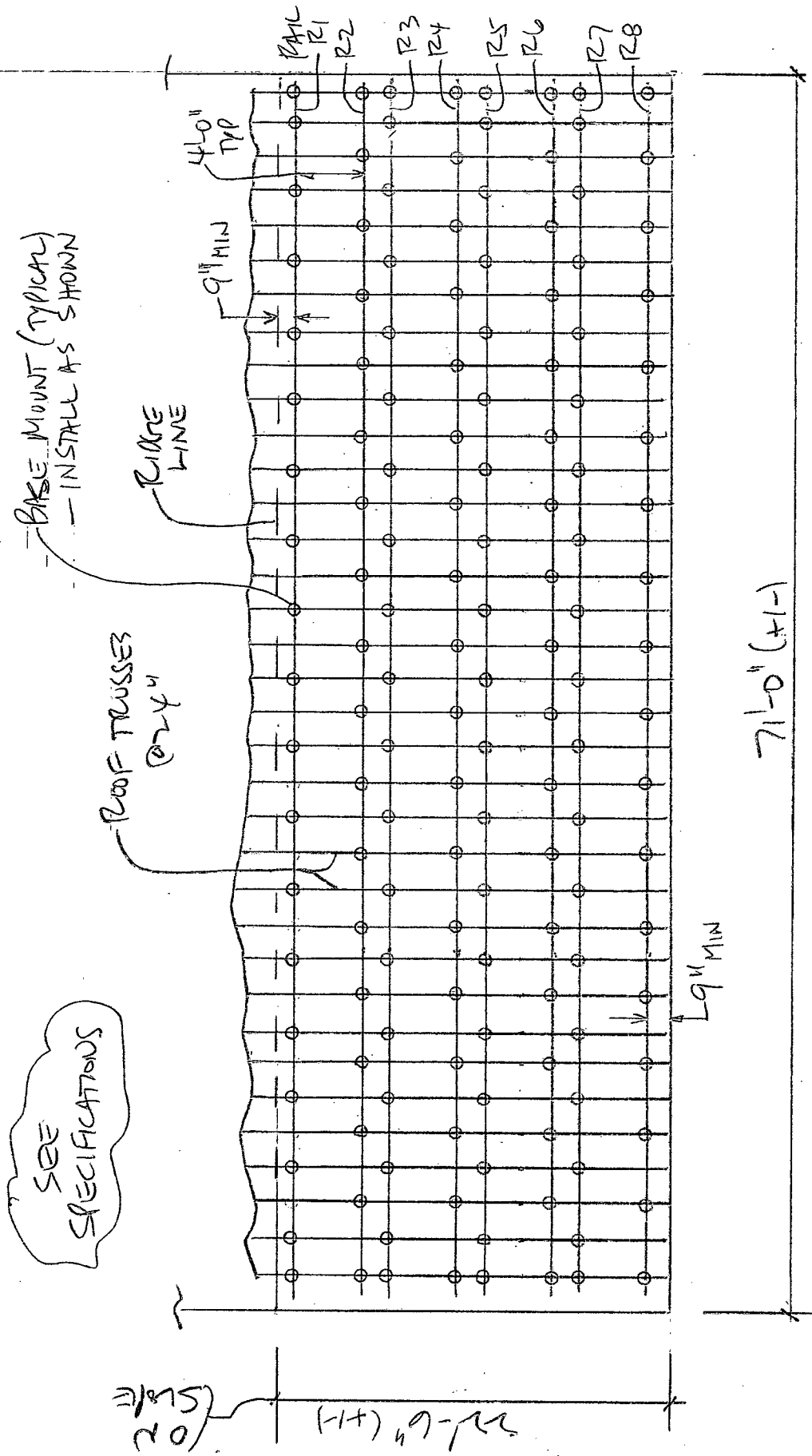
13 – Roof Vent Pipes & Obstructions

Contractor and owner shall determine how to handle obstructions caused by roof vent pipes and other obstructions, such as ventilators.

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PLAN OF RAFTERS & BASE MOUNTS — PA1 (84 PAGES)
 $\frac{1}{8}'' = 1'-0''$

Roof Support Requirements
For Proposed Solar Panels

Certification & Background Information

Certifications

Engineer has performed limited structural evaluation of existing roof framing and proposed rail-support system to support solar panels, based on available information.

Engineer provides the following certifications, subject to conditions of these specifications;

- ☒ Roof trusses have adequate capacity to support proposed solar panel installation, with reinforcing as may be specified.
- ☒ Design forces (based on code provisions for new construction) applied to the support components (rails, mounts), by solar panel arrays, do not exceed design capacities published in the referenced test report.
- ☒ Proposed rails are expected to have adequate capacity to resist design loads. However, manufacturer must provide written certification due to lack of complete load capacity information, including lateral force (parallel to roof surface).

Summary of Conditions

This entire specification must be read to completely understand all conditions.

Certification is based on the following specific conditions;

1. Rails shall be located to avoid installation of lag screws into any part of the truss top chord where risk of splitting is relatively high.

The following general conditions apply;

- GC1. Truss members shall have lateral bracing at locations specified on truss design diagrams (by truss manufacturer) or as specified by professional engineer (working for owner) based on detailed structural analysis of as-built trusses.
- GC2. Verify that roof framing members to support solar panels are in good condition, without obvious damage. Repair any damage per specifications, or consult engineer.
- GC3. Verify all dimensions shown on plans.
- GC4. Base mounts shall be offset (staggered) as shown on plans.
- GC5. Lag screws for base mounts shall be installed into center of roof framing members. Any damage caused to roof framing members shall be properly repaired.

Roof Support Requirements
For Proposed Solar Panels

Background Information

Information about existing roof framing and building conditions has been obtained from contractor.

These specifications are based on the following information provided by contractor;

- ☒ Description of solar panel requirements
- ☒ Basic details of roof framing (member sizes, arrangement) to support solar panels
- ☒ Photos of roof framing (from inside attic space) to support solar panels

Specifications are also based on the following reference information;

- ☒ Product information for solar panels (SF220 230W by Hanwha Solar One)
- ☒ SolarMount Code-Compliant Installation Manual 227.3 by Unirac
- ☒ SolarMount Technical Data Sheet, Pub 100602-1td V1.0 June 2010, by Unirac

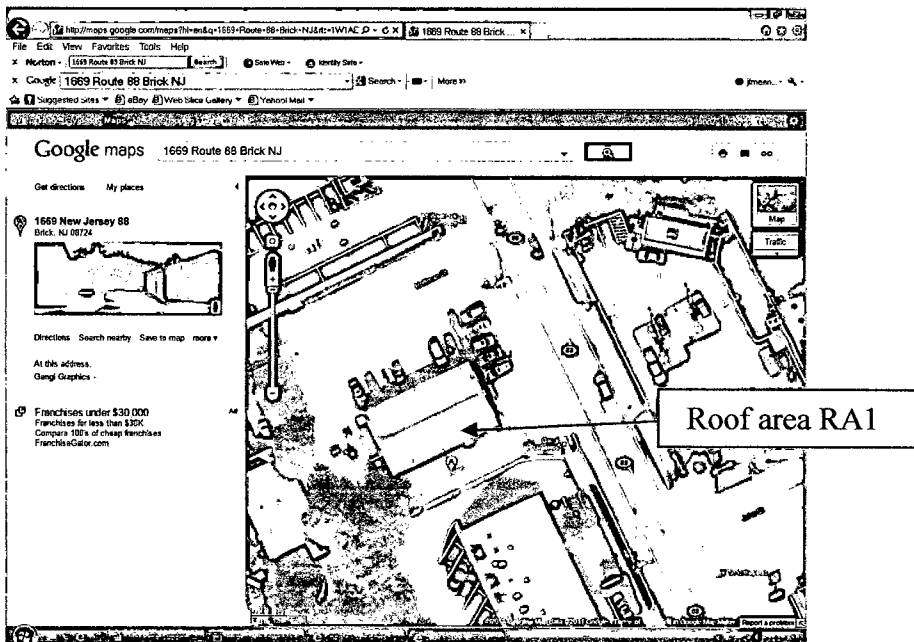
Roof Support Requirements
For Proposed Solar Panels

Description of Building

Existing one-story wood-framed building is used for business.

Front wall, facing street, is considered the north wall. Directions right and left are taken as looking at back (south) wall from outside.

Aerial view of building can be seen by clicking "Satellite" on Google map and zooming in.



Roof Configuration; General Description

Configuration of is a symmetrical gable with ridge parallel to front wall.

The following roof areas are defined for this discussion;

RA1 Back slope of main gable roof

Slope of roof area RA1 is estimated to be 4 vertical to 12 horizontal.

Roof Support Requirements
For Proposed Solar Panels

General Arrangement of Solar Panels

One array / group of solar panels (PA1 shall be installed on the following roof areas;

<u>Panel Array</u>	<u>Roof Area</u>
PA1	RA1

Dimensions of each solar panel (SF 220 230W by Hanwha Solar One) are 39.37 inches wide by 65.04 inches long. In general, the long dimension of panels may be set parallel or perpendicular to roof framing members, to allow for maximum number of panels. Panel setup (orientation) designation is as follows;

PS-Long	Long dimension parallel to roof framing members
PS-Short	Short dimension parallel to roof framing members

Each row of panels is to be supported by two (2) rails, with basic spacing (along slope) of 4'-0" (PS-Long) or 2'-8" (PS-Short). Rail spacing may be reduced to minimum of 3'-6" (PS-Long) or 2'-2" (PS-Short) if required to clear obstructions and with approval of panel manufacturer.

- ☒ If rail spacing is to be less than minimum basic spacing (3'-6" or 2'-2"), contractor shall verify that rail spacing is approved by the solar panel manufacturer.

Arrangement of rails and base mounts is shown on "Plan of Rails & Base Mounts" for each panel array as follows;

PA1	PS-Long	84 panels	(4 rows of 21 each; maximum)
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Number of panels installed may be more or less, depending on various factors including obstructions from elements such as existing chimneys, ventilators and vent pipes.

Roof Support Requirements
For Proposed Solar Panels

Roof Framing

Roof framing to support solar panels consists of prefabricated wood roof trusses, generally spaced at 24 inches. Per contractor, roof truss diagrams are not available from owner.

Contractor has provided digital photos of roof trusses to support solar panels (from inside attic space).

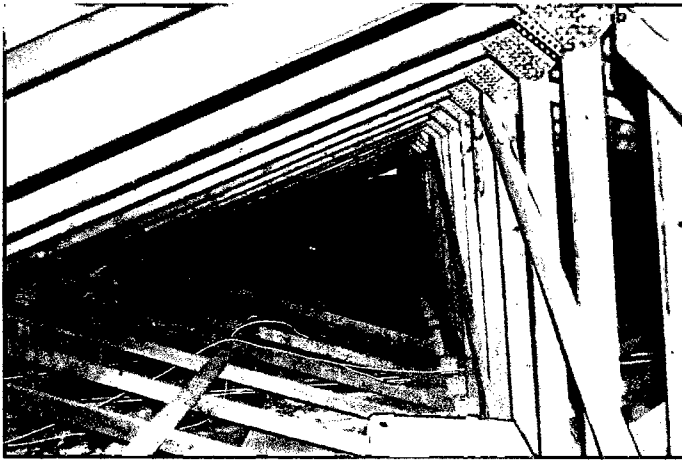


Photo 1 - Roof trusses. Lateral bracing across sloped webs.



Photo 2 - Sloped bracing across center verticals.

Roof Support Requirements
For Proposed Solar Panels

Roofing & Roof Sheathing

Existing roofing consists of asphalt shingles.

Roof sheathing is plywood.

Any damaged roof sheathing should be reinforced from underneath, to prevent more severe damage during construction and to minimize risk of damage to roofing in the future that could be difficult to repair once solar panels are installed.

Effect of Solar Panels on Roof Framing

Weight of solar panels marginally increases total permanent ("dead") load that roof framing must support.

Weight of solar panels (about 3 pounds per square foot or less) is low compared to other loads that must be supported by roof framing. However, weight of panels is not applied evenly (uniformly) to the roof. Panels are supported by brackets or mounts that concentrate load on roof framing.

For a residential roof, the largest type of gravity (downward) load is generally snow load, as defined by the governing building code. When solar panels are installed, snow load (on solar panels) is distributed to the mounts and then to roof framing.

If mounts are not distributed evenly to roof framing members, total load on framing that must support mounts will be much greater compared to conditions without solar panels. Therefore, mounts must be offset (staggered) to distribute load from panels evenly to roof framing members.

Wind causes uplift pressure on a roof, with or without solar panels. Wind uplift pressure that would otherwise be applied to the roof surface is assumed to be applied to the surface of solar panels.

Similar to snow load, wind uplift pressure applied to solar panels is also distributed to mounts and then to roof framing. Secure connections are required to transfer wind uplift force from mounts to roof framing.

Roof Support Requirements
For Proposed Solar Panels

Evaluation of Existing Roof Framing

The only practical way to provide complete structural evaluation of roof trusses would be to obtain truss diagrams from the office of the construction official.

For projects in New Jersey, roof trusses are most often designed for 30 psf uniform snow load or greater. However, even if trusses were designed for snow load of 25 psf, load applied by solar panels (through base mounts) is not excessive, for the following reasons;

1. Per standard code provisions, required uniform snow load (on both slopes, simultaneously) is 13 psf, without taking into account reduction allowed for slippery roof surface (such as glass of solar panels). Minimum uniform live load is 16 psf.
2. Base mounts are to be distributed evenly on all roof trusses, so that total snow load applied to each truss remains effectively the same as current conditions.
3. Additional weight of solar panels (3 psf) is very low. Weight of permanent materials ("dead load") used for design of roof trusses typically allows for 2 psf additional.
4. Design capacity of prefabricated roof trusses is generally much greater than required for the design loads, which are conservative.

Key issue for any roof truss evaluation is whether or not web members must be braced.

In general, lateral bracing is required for long web members that must resist compression force due to gravity load (weight of roof and snow on roof) or wind uplift.

Line of 2x4 bracing has been installed on the long sloped web members (Photo 1).

Resistance To Wind Uplift

Resistance to wind uplift force is dependent on connections between roof framing members and top of support walls. There is no information about these connections. However, due to additional weight of solar panels, wind uplift forces at ends of roof framing members are expected to be less than wind uplift forces for existing conditions (without solar panels).

Roof Support Requirements
For Proposed Solar Panels

Connections; Base Mounts to Roof Framing

Design of connections between base mounts and roof framing members is based on the key assumption that wind uplift pressures on solar panels will be essentially the same as wind uplift pressures on the existing roof without solar panels.

Design Capacity of SolarMount Rails

Design capacity of SolarMount rails (also termed "beams" by Unirac) is determined by reference to the following;

- ☒ Table 8 (page 12) in SolarMount Installation Manual 227.3
- ☒ Table of rail properties (page 4) in SolarMount Data Sheet

Table 8 allows for rail selection based on span length and uniform loading.

Roof Support Requirements
For Proposed Solar Panels

Evaluation of SolarMount Rail Load Capacity per Installation Manual

Load capacity for SolarMount rails (per requirements of SolarMount Installation Manual) are not completely representative of actual installed conditions expected for the sloped roof, as noted below.

Verification of load capacity for SolarMount rails shall be provided by rail manufacturer (Unirac), as required by Conditions of Certification.

The following effects can be expected due to differences between conditions of product information (on level surface) and installed conditions (on sloped roof).

1. For sloped roof, uniform gravity load (such as weight of snow) applies lateral force to the rail (parallel to roof slope) in addition to "normal" force, which acts perpendicular to roof surface. These two load components result in biaxial bending of the rail.
2. Installed rails will be continuous over numerous supports.
3. Wind uplift pressure is variable (non-uniform).

For typical roof slopes, normal force (perpendicular to roof surface) and lateral force (parallel to roof surface) are listed below, as percent of vertically-acting gravity load.

<u>Slope</u> <u>Vert : Horz</u>	<u>Slope Angle</u> <u>From Horizontal</u>	<u>Normal</u> <u>Force</u>	<u>Lateral</u> <u>Force</u>
3 : 12	14.0 degrees	97	24
4 : 12	18.4 degrees	95	32
5 : 12	22.6 degrees	92	38
6 : 12	26.6 degrees	89	45
7 : 12	30.3 degrees	86	50
8 : 12	33.7 degrees	83	55
9 : 12	36.9 degrees	80	60
10 : 12	39.8 degrees	77	64
12 : 12	45.0 degrees	71	71

For the estimated 4 on 12 roof slope of RA1, normal force (perpendicular to roof surface) is 95 percent of gravity load. For maximum design snow load (unbalanced) of 20 psf, plus weight of solar panels (3 psf), linear design load on each rail is then 59 PLF.

When connected to each pair of rails, solar panels act like a structural plate element ("diaphragm"), tending to prevent lateral bending deflection of rails. Although there is no way to fully evaluate such effect without test data, solar panels acting as a diaphragm effectively eliminate much of the lateral force for the rails (though not for base mounts).

John F Mann, PE
GE29049

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Belmar NJ 07719

Roof Support Requirements
For Proposed Solar Panels

Rail manufacturer provides design capacity only for loading perpendicular to strong axis of rails. Rail manufacturer claims that rails have adequate capacity for weak-axis load, parallel to roof slope. However, manufacturer does not publish weak axis design capacities for the proprietary section.

Engineer certifies only strong axis design capacity for rails.

Contractor or owner should consider submitting request for written verification that rails have design capacity to resist combined vertical and lateral design loads per these specifications.

L-Bracket Mounting System

Evaluation of the Unirac L-bracket ("L-foot") mounting system is based on information in the SolarMount Technical Data Sheet (page 3).

SolarMount rails are bolted directly to vertical leg of the L-bracket mounts.

Allowable load parallel to roof surface (perpendicular to rails) is the Tranverse force (misspelled Traverse by Unirac) in the table. For service load design (without load factors), the "Allowable Load" of 213 pounds is applicable.

Roof Support Requirements
For Proposed Solar Panels

Conditions of Certification

Contractor shall provide owner with these Specifications and any other drawings or documents provided by engineer, as referenced in these Specifications.

- ☒ Contractor shall make owner aware of any requirements that may be specified for the owner. Contractor shall make all such requirements a condition of the contract between contractor and owner, or shall take responsibility for making other arrangements to have others perform such requirements.

The following conditions of certification are described in these specifications;

1. Solar Panel System Design
2. Intent and Scope of Engineering Certification
3. Design Details
4. Prevention of Roof Leaks
5. SolarMount Rails & Mounts; Verification of Design Capacity
6. Evaluation of Existing Roof Framing For Wind Uplift
7. Support Requirements for Solar Panels
8. Additional Inspection & Reinforcement of Roof Framing
9. Design for Gravity Loads
10. Design for Wind Loads
11. Design Capacity of Lag Screws
12. Roof Sheathing
13. Roof Vent Pipes & Obstructions

1- Solar Panel System Design

Design of system configuration, including number and size of panels, electric supply and arrangement of various components, shall be provided by owner as required by the Construction Official.

Solar panels shall be installed on existing roof areas as shown on plans provided by contractor.

Design of solar panels, support rails, base mounts and other system components shall be responsibility of applicable manufacturer.

Roof Support Requirements
For Proposed Solar Panels

2- Intent and Scope of Engineering Certification

Engineering certification of roof framing does not include detailed structural analysis of the entire roof framing system or of building elements that support roof framing.

For this evaluation, "roof framing" is considered to consist of rafters only.

Intent and scope of certification is limited to the following;

- ☒ For roof framing to support solar panels, determine (by calculation) the following;
 1. Load capacity using provisions of building code for new construction, modified as appropriate, and conservative assumptions about material properties.
 2. Required load capacity based on; (1) Design loads specified by building code (for new construction), (2) Weight of solar panels and (3) Arrangement of solar panel support system (rails + base mounts) as required by these specifications and attached "Plan of Rails & Base Mounts". Snow load is considered to be applied to solar panels as if solar panels are the roof surface.
- ☒ If calculated load capacity is less than required capacity, develop requirements for remedial work to reinforce existing roof framing, if practically feasible. Otherwise, inform contractor that installation of solar panels is not recommended.
- ☒ Determine maximum base mount spacing (along panel support rail) based on rail design capacity (or test report information) provided by rail manufacturer. However, conditions to this certification may apply, especially if manufacturer has not provided design capacity for sloped roof conditions.
- ☒ Provide limited evaluation of existing roof framing conditions to determine if there are any major existing defects, such as decay damage (from water) or improper modifications (such as for skylights). Owner and contractor are responsible for detailed inspection of existing conditions.
- ☒ Determine requirements for connection of rail supports to roof framing to provide adequate capacity to resist wind uplift forces, based on code-specified wind pressures for new construction.

Roof Support Requirements
For Proposed Solar Panels

3- Design Details

The following design details are attached to these specifications;

1. Plan of Rails & Base Mounts – PA1

Contractor shall verify dimensions and conditions shown on Plan of Rails & Base Mounts, especially framing for dormers and skylights (if applicable for roof slope to support panels). Report significant differences for actual conditions to engineer to allow for evaluation, as appropriate.

- ☒ If actual sloped dimension of roof area is less than sloped dimension shown on plan, the number of solar panels may have to be reduced. Contractor shall verify dimensions before completing design of solar panel system.

4 – Prevention of Roof Leaks

Contractor and owner are completely responsible for design of methods used to prevent roof leaks.

Roof Support Requirements
For Proposed Solar Panels

5- SolarMount Rails & Mounts; Verification of Design Capacity

Unit design loads for rails are as follows;

Snow Load; Unbalanced condition	59 PLF (Perpendicular to roof surface)
	20 PLF (Parallel to roof surface)
Wind Uplift; Components & Cladding	98 PLF (Perpendicular to roof surface; Rail R1)

For snow load, both design forces act simultaneously. Weight of solar panels has been included.

Wind uplift includes offset from weight of solar panels (taken as 2 psf).

- ☒ Based on Table 8 and analysis of rail stresses (using published design properties), standard rails have adequate capacity to resist design loads.

For rail support angle (L-foot) spaced at 4'-0", the following design forces and allowable loads are applicable;

	<u>Design Force</u>	<u>Allowable Load</u>	
Snow; perpendicular to roof surface	236 lbs	1,325 lbs	OK
Snow; parallel to roof surface	80 lbs	213 lbs	OK
Wind uplift	396 lbs	707 lbs	OK

See Section 11 for shear capacity of lag screw connecting base mount to roof framing.

Roof Support Requirements
For Proposed Solar Panels

6 - Evaluation of Existing Roof Framing For Wind Uplift

Roof framing must resist wind uplift pressure on roof (and solar panel) surfaces. Engineer has not evaluated capacity of connections between framing members and supports to resist code-specified wind uplift pressures.

If building design plans are available, plans could be reviewed to evaluate specified connections. However, some inspection would be required to verify that as-built connections were made as specified on plans.

The alternative would be to remove finish materials (and perhaps exterior wall sheathing) along each support to allow for inspection and evaluation.

7 - Support Requirements for Solar Panels

Installed weight of solar panel shall not exceed 3 psf over area of solar panel. Contractor shall supply certification of panel weight from manufacturer to owner and Construction Official.

Panels shall be supported on SolarMount aluminum rails manufactured by Unirac; see Installation Manual for complete details.

Connection of rails to roof must distribute the following forces to roof framing;

- ☒ Weight of solar panels
- ☒ Weight of snow on panels
- ☒ Wind uplift pressure applied to panels

A base mount (L-bracket or angle) supports rails directly. Base mount is connected to roof framing members using a single lag screw. Base mounts shall be located per general description in these specifications or per plan of base mounts if provided.

- ☒ If a plan of base mounts is attached, base mounts shall be located as shown on such plan, which takes precedence over general description in these specifications.

Each row of solar panels shall be supported on two rails running perpendicular (across) roof framing members.

Roof Support Requirements
For Proposed Solar Panels

Rails shall be connected to existing roof framing members as specified below;

1. For each rail, base mounts shall be installed above roof framing members at locations shown on plan of rails and base mounts.

General guidelines are as follows;

End of each rail may cantilever past the base mount a maximum of 16 inches or as specified by the rail system manufacturer, whichever is less.

Each Rail - End of rail + As shown Plan of Rails & Base Mounts

Except as shown on Plan of Rails & Base Mounts, base mounts on adjacent rails must be offset (staggered) so that the base mount for one rail is not on the same roof framing member as the base mount for the adjacent rail.

2. Owner and contractor are responsible for ensuring that base mount manufacturer has designed connections to be installed on existing roof such as to prevent roof leaks with proper installation. Owner and contractor are responsible for proper installation and all sealing necessary to prevent roof leaks. Owner shall submit any design details, showing how roofing is to be protected, that may be required by the Construction Official.
3. Each mounting assembly shall be connected to top of roof framing member using one lag screw; 5/16 inch diameter by 3- inch minimum.
4. Each lag screw must be installed as close as feasible to center of 1-1/2 inch thick roof joist. Minimum edge distance, from center of lag screw to edge of wood member, is 1/2 inch.
5. If roof framing member is not straight (bowing sideways), it may be necessary to install a ledger board up against the joist to provide sufficient solid wood for installing lag screws. Such ledger board shall be connected to the framing member with #8 wood screws spaced at 4 inches maximum. For nominal two inch thick ledger board up against nominal two inch thick framing member, screws shall be 3 inches long. Screws shall extend at least 1.25 inches into roof member. However, if roof member is bowing significantly, owner should also have additional engineering evaluation performed.

Roof Support Requirements
For Proposed Solar Panels

6. Any lag screws that split wood support member (rafter, roof joist, truss top chord) shall be removed. For minor splits, wood support members shall be reinforced with new, nominal two inch thick wood sections on each side. The mount shall be relocated so that a new lag screw is installed into new wood. Each section of new wood shall be at least 4 feet long, centered on the split location, and screwed to side of rafter with six (6) #8 wood screws.
7. Any major splits of wood framing members require more extensive repairs. Consult engineer for requirements.

8 – Additional Inspection & Reinforcement of Roof Framing

Contractor shall perform additional inspection as may be required to verify the assumed conditions (if any) listed for "Evaluation of Existing Roof Framing".

Contractor shall inspect underside of roof sheathing from inside attic space to determine extent of any damaged roof sheathing to be reinforced with new plywood between rafters. Install ledger boards (nailed to rafters) under edges of reinforcement sheathing. At vent pipe, install two strips of plywood, one on each side of pipe.

For any rafters with long or wide splits (especially splits through bottom edge of rafter), install reinforcement board (of same size as rafter) alongside, connected to rafter with wood screws (10 gage x 3 inch) spaced at 10 inches. High end of reinforcement shall extend to ridge board. Low end of reinforcement shall extend at least 3 feet past low end of the split or other damage, or as close as feasible to low end of rafter.

For any wide gaps between high end of rafter and ridge board, install light-gage steel joist hanger, using short 8d x 1-1/2 inch nails. As alternative to joist hanger, a reinforcement board (at least 3 feet long) may be installed, connected to rafter, with high end tight to ridge board. Connect reinforcement board to ridge board with light-gage steel A35 framing angle.

Roof Support Requirements
For Proposed Solar Panels

9 - Design for Gravity Loads

Design dead loads are based on actual weight of materials (if known) or standard assumed weights per building code provisions.

Weight of solar panels is per product data sheet provided by contractor.

Dead Load	5 psf (roofing + roof sheathing)
Weight of solar panels	3 psf

For determination of snow load, the roof slope to support solar panels has been considered part of a simple gable roof. Therefore, unbalanced snow load is applicable.

Design live loads listed below are based on applicable provisions of the UCC (Rehabilitation subcode) and building subcode (IRC 2009).

Ground Snow Load	20 psf (per UCC Bulletin 94-8)
Importance Factor	1.0 (ASCE 7-05; Table 7-4)
Exposure Factor, Ce	0.9
Thermal Factor, Ct	1.1
Sloped Roof Snow Load; uniform	13.9 psf (asphalt shingle surface)
	11.9 psf (slippery glass surface)
Unbalanced Snow Load	
Leeward slope; uniform	11.9 psf (slippery glass surface)
Surcharge	13.8 psf
Length of surcharge	6.7 feet (heading down from ridge)
Minimum Live Load	16.0 psf (IRC 2009 NJ; Table R301.6)

Glass surface of solar panels qualifies as "slippery" per ASCE 7-05 (7.4), which reduces sloped roof snow load for balanced conditions, per code provisions.

However, for unbalanced snow loading, slippery roof surface does not decrease snow load unless horizontal length of slope (W; eave to ridge) is greater than 20 feet. For this house, maximum W (for PA1), about 22.5 feet, is large enough such that unbalanced snow load may be reduced for slippery surface.

Roof Support Requirements
For Proposed Solar Panels

10 - Design for Wind Loads

Basic Wind Speed (3-second gust)	115 mph (per UCC Bulletin 03-4)
Exposure Category	B
Mean Roof Height	20 feet

Wind uplift pressures (gross) on roof surface (solar panels) per ASCE 7-05 (Figure 6-3);

Roof Slope	18.4 degrees (RA1)
Effective Wind Area	10 sf
Adjustment Factor	1.00
Zone 1; C-C	21.8 psf
Zone 2; C-C	38.0 psf
Zone 3; C-C	58.2 psf

For further discussion, the term "row" is taken to be parallel with ridge. The term "column" is taken to be perpendicular to ridge.

Each pair of rails resists wind force from one row of solar panels (parallel to ridge).

Net uplift force is based on 2 psf for weight of panels, subtracted from gross uplift pressure.

Zone 2 uplift pressures are applicable within each "edge strip", which occurs along; (1) Each end of the roof, (2) Each side of ridge, (3) Each low edge (eave), and (4) Each side of any hip or valley line.

Zone 3 uplift pressures are applicable where edge strips overlap, generally at corners of each roof surface.

Width of each edge strip is per standard code provisions (minimum 3.0 feet).

Roof Support Requirements
For Proposed Solar Panels

For calculating wind uplift forces on base mounts, the following conditions are defined;

Condition 1 – Tributary uplift pressures from Zone 1 only. This condition typically occurs only when an outer edge of the panel array is not within the edge strip, or when an array includes more than 4 rows of base mounts.

Condition 2A – Base mounts along ridge and eave subject to edge strip pressures. Tributary uplift pressure is typically from Zone 1 and Zone 2.

Condition 2B – Column of base mounts nearest to end of roof, if subject to edge strip pressures. Tributary pressure is typically from Zone 1 and Zone 2.

Condition 3 – Base mounts subject to Zone 3 pressure.

Net wind uplift forces to be resisted by base mounts are listed below for row of base mounts.

For each panel array, rails are designated from upper rail nearest to ridge (R1) to lower rail. Distance below ridge is approximate, along the roof slope.

Roof Support Requirements
For Proposed Solar Panels

Base Mount Uplift Forces (Lbs) – PA1 (84 panels)

Length of panels (along slope) = 21'-8" (4 @ 5'-5")

Rail spacing (along slope) = 4'-0" (4 rows; 8 rails)

Length of roof slope = 22'-6" (to be verified)

Ridge to rail R1 = 0'-9"

Base mount spacing; (along rail, for calculation purposes only)
Rails R1 - R8 = 48 inches (maximum)

** Not Applicable

Rail	Below Ridge	Distance	Condition 1	Condition 2A	Condition 2B	Condition 3	Condition
R1	0.70 ft	**	385	**	461		
R2	4.75 ft	**	281	356	**		
R3	6.17 ft	215	**	290	**		
R4	10.17 ft	215	**	290	**		
R5	11.59 ft	215	**	290	**		
R6	15.59 ft	215	**	290	**		
R7	17.01 ft	**	238	313	**		
R8	21.01 ft	**	331	**	406		

- ☒ For each rail, maximum net uplift force (base mounts) is less than design pullout capacity (512 lbs) for specified lag screws (5/16" dia; 3-inch minimum length for Unirac L-bracket).
- ☒ For each panel array, required base mount spacing is specified on Plan of Rails & Base Mounts. Specified base mount spacing may be less than the maximum spacing listed above to ensure proper distribution of load to roof framing members.

Roof Support Requirements
For Proposed Solar Panels

11 – Design Capacity of Lag Screws

Design capacity of lag screws (5/16-inch) is based on the following conditions;

- ☒ Rafter is Spruce-Pine-Fir (SPF) or Hem-Fir wood
- ☒ Standard lag screw thread configuration and steel properties per ANSI B18.2.1
- ☒ Penetration of lag screw thread into wood rafter is at least 1.75 inches
- ☒ Lag screw installed into center of rafter thickness. Edge distance of 1/2-inch minimum.
- ☒ Load Duration Factor for wind (per NDS-05) = 1.6

Design pullout capacity of lag screw = 512 lbs

For increased penetration into rafter (such as for longer lag screw), pullout capacity is greater.

12 - Roof Sheathing

Roof sheathing shall be in good condition, without any obvious damage or decay.

Roof sheathing must have adequate connection to roof framing members to ensure that framing members have proper lateral bracing.

Contractor shall inspect roof sheathing from inside the attic space.

For roof sheathing that will be under proposed solar panels, any damage shall be repaired prior to installation of panels.

13 – Roof Vent Pipes & Obstructions

Contractor and owner shall determine how to handle obstructions caused by roof vent pipes and other obstructions, such as ventilators.

RECEIVING CLERK 88
DATE REC'D 9/11/11

ZONING PERMIT APPLICATION

PERMIT # 2P-11-00819
DATE ISSUED 10/3/11

BLOCK: 835 LOT: 31 QUALIFIER: — SITE ADDRESS: 1669 Rt 88 Brck

IDENTIFICATION:

1. NAME OF OWNER IN FEE: Gary Graphics

COMPLETE ADDRESS: 1669 Rt 88

Brck NJ 08724

PHONE # (732) 245-0875 EMAIL: gshuba@stuewhutman.com

2. NAME OF APPLICANT: Gary Graphics

APPLICANT ADDRESS: 1669 Rt 88

Brck

PHONE # (732) 245-0875 EMAIL: gshuba@stuewhutman.com

3. RESPONSIBLE PERSON FOR WORK: Gary Shuba

PHONE # (732) 861-6056 FAX # (732) 245-9259

4. SIGNATURE OF APPLICANT: [Signature]

FOR OFFICE USE ONLY

FEE SUMMARY:

APPLICATION FEE: \$ 50.00

OTHER: \$ —

TOTAL: \$ —

RESIDENTIAL: ✓

COMMERCIAL: SPD

EXISTING USE: SPD

PROPOSED USE: SPD

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: — (*APPLICABLE)

OTHER: Solar panels on existing roof, no overhangs

DESCRIPTION: Panels mounted on roof, metal inverters under panels

ZONING REVIEW: 9-13-11

DATE REVIEWED: 9-13-11

DATE DENIED: —

DATE APPROVED: 9-13-11

INTLS: SC, 20

(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

LAND USE

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. 354-2AAA-84; 11-5-1984 by Ord. No. 354-2CCC-84; 6-24-1986 by Ord. No. 354-2WVVV-86; 9-13-1988 by Ord. No. 354-2TTT-88; 9-27-1988 by Ord. No. 354-2XXX-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 Building Height				Minimum Floor/ Building Area (square feet) (2 stories/1 story)	Maximum Allowable Impervious Coverage
	Interior Lots			Corner Lots			Principal Building			Accessory Building			Maximum Lot Coverage by Building		Maximum Building Height			
	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 (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	5	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
B-1	10,000	100	90	12,500	100	125	30	10	-	20	10	20	30% ²	2	-	35	38.5	1,000
B-2	20,000	125	125	20,000	125	125	50	10	-	50	10	50	30% ²	2	-	35	38.5	2,000
B-3	2 acres	200	200	2 acres	200	200	75	30	-	50	20	50	25% ²	-	-	35	38.5	2,000
B-4	5 acres	300	300	-	-	-	100	50(150')	-	100(150')	20	50	25%	3	-	35	38.5	30,000
M-1	5 acres	300	300	-	-	-	100	50	-	150	75	150	30% ²	-	-	35	38.5	5,000
R-M	25 acres	350	200	-	-	-	50	50	-	30	30	30	20%	-	25	35	38.5	-
O-P-T	40,000	150	150	40,000	150	150	50	20	-	50	20	50	25% ²	2	-	35	38.5	2,000
H-S	See § 245-261.																	

See § 245-261.

See § 245-90.

See § 245-103.

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 new yard setback requirements for accessory buildings on waterfront property, see § 245-10D.

SEP 13 2011
KJZ

SEP 13 2011

DATE REVIEWED: 9-13-11 DATE DENIED: DATE APPROVED: 9-13-11 INTLS: 5528

[illegible]



Brick Township
401 Chambers Bridge Rd.

Brick, NJ 08723
(732) 262-1027

Date Issued: _____
Application Number: ZA-11-00969
Application Date: 09/13/2011
Project Number: _____
Permit Number: _____
Fee: \$50

Zoning Permit

Worksite **1669 ROUTE 88**
Location: **Laurelton**
BRICK, NJ 08724

Block: **835**
Lot: **37**
Qualifier: _____
Zone: **B-1**

Owner: **1669 ROUTE 88 WEST LLC**
Address: **1669 ROUTE 88**
BRICK, NJ 08724

Applicant: **1669 ROUTE 88 WEST LLC**
Address: **1669 ROUTE 88**
BRICK, NJ 08724

Application Approved Date: 09/13/2011

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

Use is: Commercial - "Gangi Graphics" print shop.

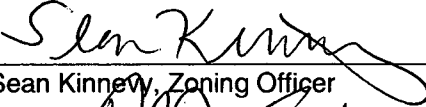
Nonconforming Use is: _____

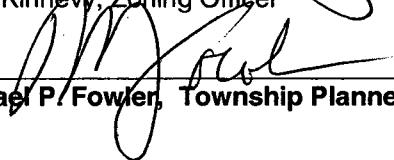
Work Description:

Solar Panels - 84 photovoltaic modules, 22KW, mounted on the roof of the building.

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

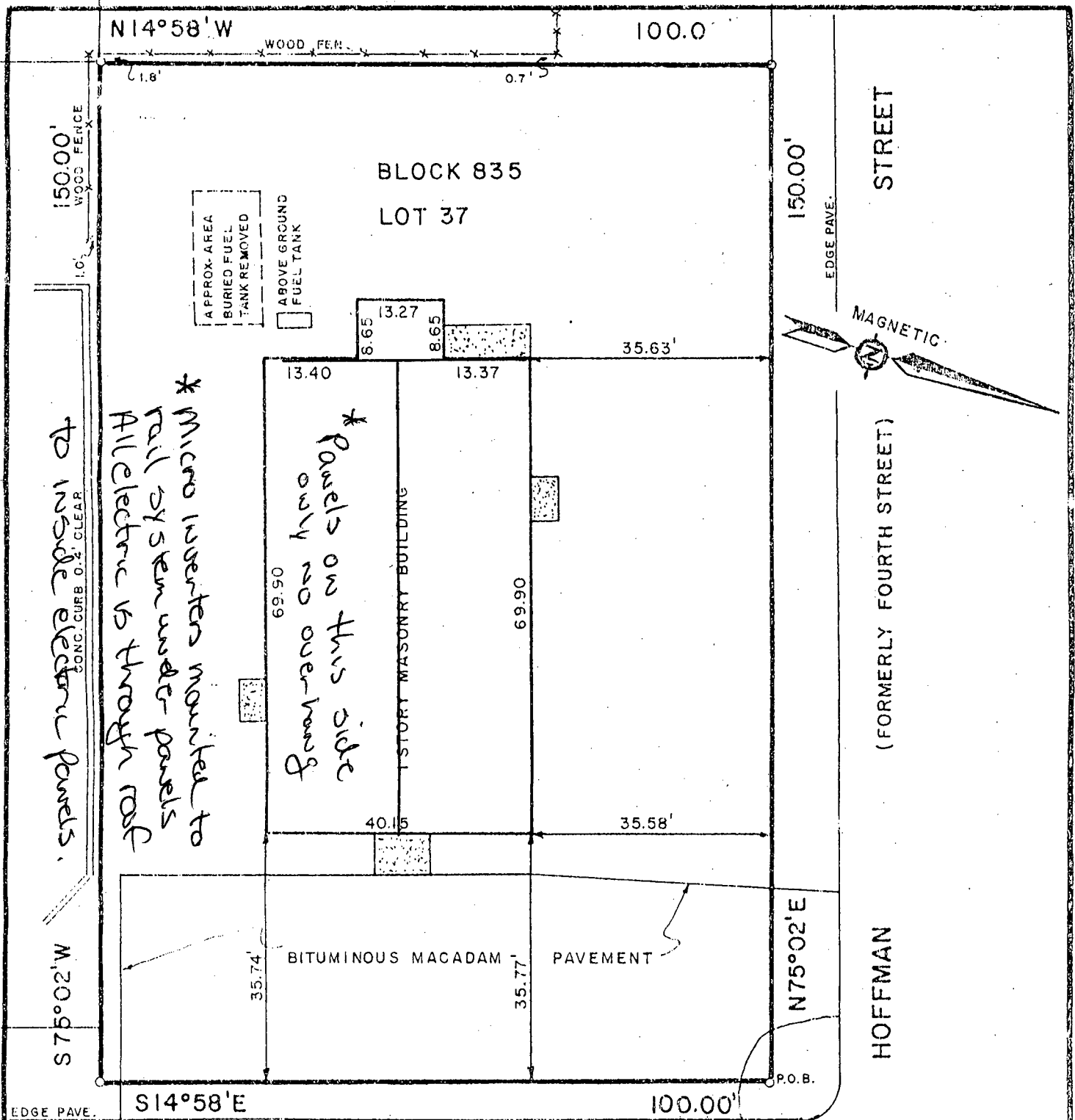

Sean Kinney, Zoning Officer


Michael P. Fowler, Township Planner

09/13/2011

Date

9/13/11
Date



NEW JERSEY STATE HIGHWAY ROUTE 88

PROPERTY ALSO KNOWN AS LOTS 37, 38, 39 & 40, BLOCK 10 ON THE MAP
OF LAURELTON PARK COMPANY, FILED IN THE OCEAN COUNTY CLERK'S
OFFICE ON SEPTEMBER 25, 1929 AS MAP A-328

APPROVED FOR ZONING ONLY
SEAN KINNEVY, ZONING OFFICER

SURVEY OF PROPERTY FOR WILLIAM, RAYMOND & JOHN NEWTON

SITUATED IN TOWNSHIP OF BRICK, OCEAN COUNTY, NEW JERSEY

FILE NO. 2838

SCALE 1"=20'

DATE 10-01-97

CERTIFIED TO:

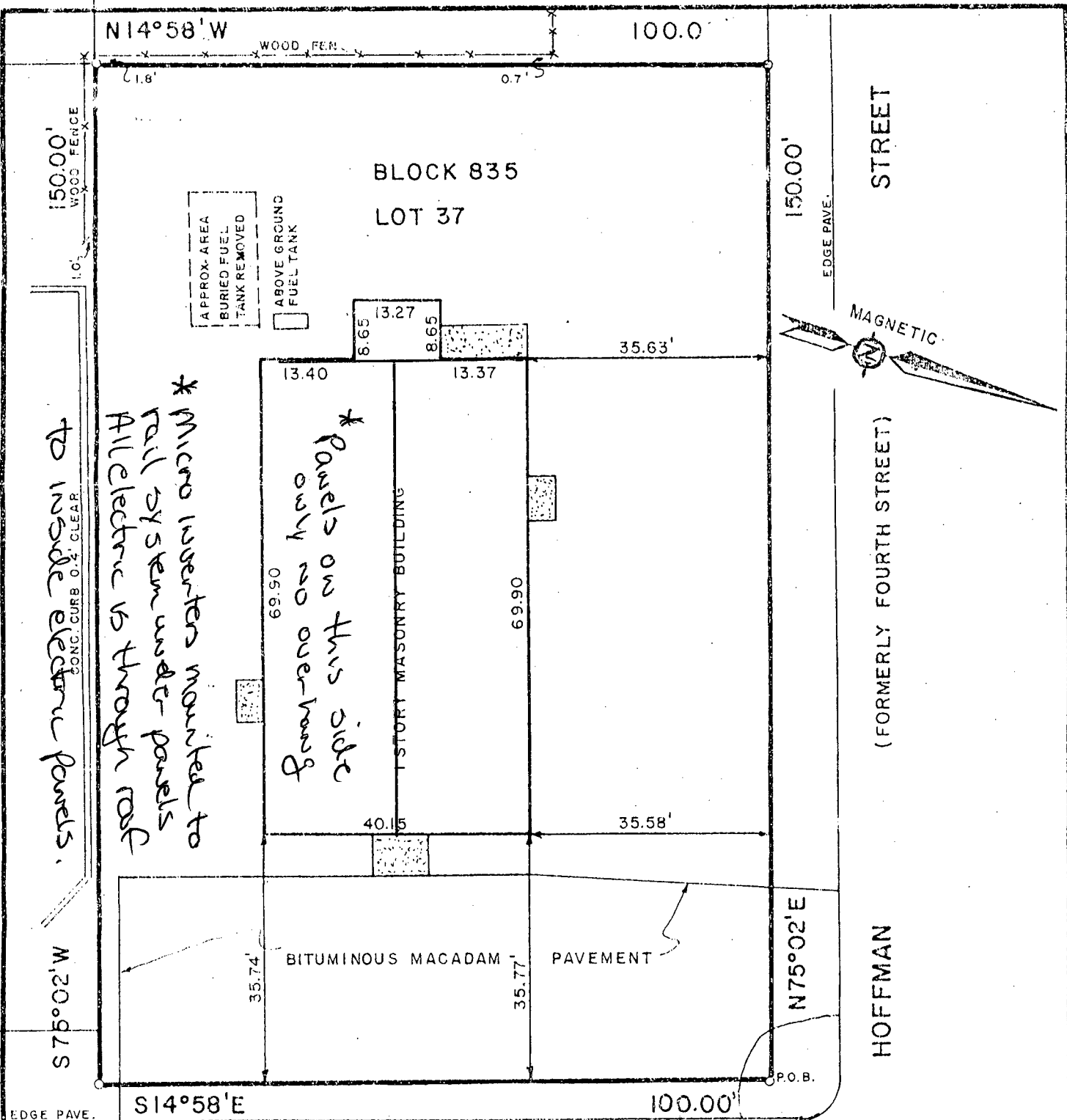
William Newton, Raymond Newton &
John Newton,
Owen B. Pearce, Esq.

SEP 13 2011
SOLAR PANELS
THOMAS H. STUART JR
PROFESSIONAL LAND SURVEYOR LIC NO. 18593

1223 NARRUMSON ROAD MANASQUAN, N.J.

908-520-6625

The certification is made only to above named parties for purchase and/or mortgage of herein delineated property by above named purchaser. No responsibility or liability is assumed by Surveyor for use of survey for any other purpose including, but not limited to, use of survey for survey affidavit, resale of property or to any other person not listed in certification, either directly or indirectly.



NEW JERSEY STATE HIGHWAY ROUTE 88

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APPROVED FOR ZONING ONLY
SEAN KINNEVY ZONING OFFICER

SURVEY OF PROPERTY FOR WILLIAM, RAYMOND & JOHN NEWTON

SEP 13 2011

SITUATED IN TOWNSHIP OF BRICK, OCEAN COUNTY, NEW JERSEY

SOLAR PANELS

FILE NO. 2838

SCALE 1"=20'

DATE 10-01-97

CERTIFIED TO:

William Newton, Raymond Newton &
John Newton,
Owen B. Pearce, Esq.

THOMAS H. STUART JR.
PROFESSIONAL LAND SURVEYOR LIC NO. 18583

1223 NARRUMSON ROAD MANASQUAN, N.J.

908-528-6625

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