

MONTGOMERY COUNTY HISTORIC PRESERVATION COMMISSION
STAFF REPORT

Address: 7019 Eastern Avenue, Takoma Park **Meeting Date:** 10/11/2023
Resource: Contributing Resource **Report Date:** 10/4/2023
 Takoma Park Historic District **Public Notice:** 9/27/2023
Applicant: Sabrina Eaton **Tax Credit:** No
 (Fusion Solar Service, Agent)
Review: HAWP **Staff:** John Liebertz
Permit Number: 1043440
PROPOSAL: Solar panel installation.

STAFF RECOMMENDATION

Staff recommends that the Historic Preservation Commission (HPC) **approve** the HAWP application.

ARCHITECTURAL DESCRIPTION

SIGNIFICANCE: Contributing Resource within the Takoma Park Historic District
STYLE: Vernacular
DATE: Ca. 1890-1910



Figure 1: The subject property (noted with the yellow star) is located mid-block on Eastern Avenue. The red line is the boundary of the Takoma Park Master Plan Historic District and the boundary of the District of Columbia.

PROPOSAL

The applicant proposes to install thirteen (13) roof-mounted solar panels in three arrays. One of the arrays is located on the two-story, front-gable house and two of the arrays are located on the rear gable addition. On the historic house, the array on the southern roof slope consists of four (4) panels. On the non-historic addition, the two arrays consist of four (4) panels on the northern slope and five (5) panels on the southern slope. The ac disconnect, combiner, and other associated hardware would be installed on the northeastern (rear) corner of the house.

APPLICABLE GUIDELINES

The Historic Preservation Office and Historic Preservation Commission (HPC) consult several documents when reviewing alterations and new construction within the Takoma Park Historic District. These documents include the historic preservation review guidelines in the approved and adopted amendment for the *Takoma Park Historic District (Guidelines)*, *Montgomery County Code Chapter 24A (Chapter 24A)*, and the *Secretary of the Interior's Standards for Rehabilitation (Standards)*, and the HPC's *Policy No. 20-01 ADDRESSING EMERGENCY CLIMATE MOBILIZATION THROUGH THE INSTALLATION OF ROOF-MOUNTED SOLAR PANELS*. The pertinent information in these four documents is outlined below.

Takoma Park Historic District Guidelines

There are two broad planning and design concepts which apply to all categories. These are:

- The design review emphasis will be restricted to changes that are all visible from the public right-of-way, irrespective of landscaping or vegetation (it is expected that the majority of new additions will be reviewed for their impact on the overall district), and
- The importance of assuring that additions and other changes to existing structures act to reinforce and continue existing streetscape, landscape, and building patterns rather than to impair the character of the historic district.

A majority of the buildings in the Takoma Park Historic District have been assessed as being "Contributing Resources." While these buildings may not have the same level of architectural or historical significance as Outstanding Resources or may have lost some degree of integrity, collectively, they are the basic building blocks of the Takoma Park district. They are important to the overall character of the district and the streetscape due to their size, scale, and architectural qualities, rather than for their particular architectural features.

Contributing Resources should receive a more lenient level of design review than those structures that have been classified as Outstanding. This design review should emphasize the importance of the resource to the overall streetscape and its compatibility with existing patterns rather than focusing on a close scrutiny of architectural detailing. In general, however, changes to Contributing Resources should respect the predominant architectural style of the resource.

The following guidance which pertains to this project are as follows:

- All exterior alterations, including those to architectural features and details, should be generally consistent with the predominant architectural style and period of the resource and should preserve the predominant architectural features of the resource; exact replication of existing details and features is, however, not required.

- Minor alterations to areas that do not directly front on a public right-of-way -such as vents, metal stovepipes, air conditioners, fences, skylights, etc. should be allowed as a matter of course; alterations to areas that do not directly front on a public right-of-way which involve the replacement of or damage to original ornamental or architectural features are discouraged but may be considered and approved on a case-by-case basis.
- Alterations to features that are not visible at all from the public right-of-way should be allowed as a matter of course.
- All changes and additions should respect existing environmental settings, landscaping, and patterns of open space.

Montgomery County Code, Chapter 24A-8

The following guidance which pertains to this project are as follows:

- (b) The commission shall instruct the director to issue a permit, or issue a permit subject to such conditions as are found to be necessary to ensure conformity with the purposes and requirements of this chapter, if it finds that:
 - (1) The proposal will not substantially alter the exterior features of an historic site or historic resource within an historic district; or
 - (2) The proposal is compatible in character and nature with the historical, archeological, architectural or cultural features of the historic site or the historic district in which an historic resource is located and would not be detrimental thereto or to the achievement of the purposes of this chapter;
- (d) In the case of an application for work on an historic resource located within an historic district, the commission shall be lenient in its judgment of plans for structures of little historical or design significance or for plans involving new construction, unless such plans would seriously impair the historic or architectural value of surrounding historic resources or would impair the character of the historic district. (Ord. No. 9-4, § 1; Ord. No. 11-59.)

Secretary of the Interior’s Standards for Rehabilitation

The Secretary of the Interior defines rehabilitation as “the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features, which convey its historical, cultural, or architectural values.” The applicable *Standards* are as follows:

- 2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.
- 9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.
- 10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

Historic Preservation Commission Policy No. 20-01: Addressing Emergency Climate Mobilization Through the Installation of Roof-Mounted Solar Panels

Now, THEREFORE:

WHEREAS, Historic Area Work Permit decisions are guided by the criteria in Section 24A, The Secretary of the Interior’s Standards for Rehabilitation, and pertinent guidance from applicable master plan amendments and/or site or district-specific studies;

WHEREAS, The Secretary of the Interior’s Standards for Rehabilitation as interpreted by the National Park Service limit the placement of rooftop solar panels under Standards 2, 9, and 10 to less conspicuous locations;

WHEREAS, the County Council has established a Climate Emergency;

WHEREAS, the Historic Preservation is a body established by the County Executive and County Council;

WHEREAS, Section 24-8(b)(6) states, “In balancing the interest of the public in preserving the historic site or historic resource located within an historic district, with the interests of the public from the use and benefit of the alternative proposal, the general public welfare is better served by granting the permit;”

WHEREAS, the widespread use of solar panels, both for hot water and for electricity production, will reduce greenhouse gases in the county, in accordance with the aims of the Emergency Climate Mobilization resolution (Resolution No.: 18-974), it shall be the policy of the Historic Preservation Commission that:

1. The preferred locations for solar panel installation(s) on a designated historic site or an historic resource located within an historic district is a) on the rear of the property, b) on non-historic building additions, c) on accessory structures, or d) in ground-mounted arrays;
2. If it is not feasible to install solar panels in one of the identified preferred locations due to resource orientation or other site limitations; and,
3. The roof is determined to be neither architecturally significant, nor a character-defining feature of the resource, nor is it a slate or tile roof, that unless it can be demonstrated that the solar array will be installed without damaging the historic character of the resource or historic fabric; then
4. The public welfare is better served by approving a Historic Area Work Permit for solar panels on all visible side or front roof slopes under Section 24A-8(b)(6).
5. A Historic Area Work Permit (HAWP) is required for all work referenced in this policy.

STAFF DISCUSSION

Property History

The subject property located mid-block on Eastern Avenue is a Contributing Resource to the Takoma Park Historic District. The site features a vernacular house constructed between 1890 and 1910. The original two-story house consisted of a front-gable with a side-gable ell that created an L-shaped floor plan. The wood-frame house rests on a masonry foundation and is clad with asbestos siding (it is unknown if the original siding remains intact). The façade is adorned with a one-story, wood-frame, shed roof porch supported by Doric columns. Typical fenestration consists of nine-over-one, double-hung, wood-sash windows (*Figure 2*). A 1923 real estate advertisement described the house as follows:

“COTTAGE, FIVE ROOMS, BATH, SLEEPING porch, sun parlor, hardwood floors, laundry room, maid’s room; 1½-story garage...”¹

There have been numerous alterations to the form of the house since its initial construction (*Figure 2*). Between 1916 and 1927, the property owners constructed a one-story addition to the south and a two-story addition with an open first-story porch to the east (rear). Other minor alterations occurred at the rear of the house in the twentieth century, but the next major alteration occurred in 2010 when the HPC approved the construction of a two-story rear addition with a screened-in porch.²

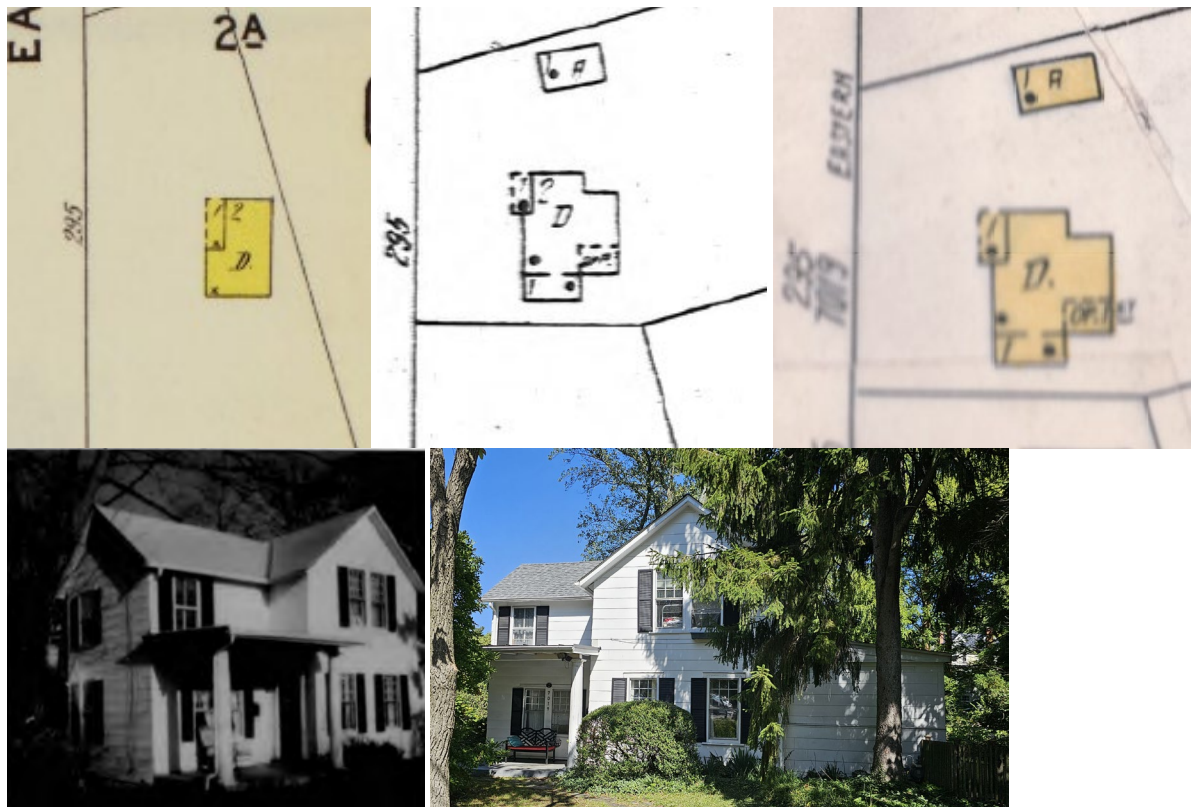


Figure 2: View off the Sanborn Fire Insurance Maps showing the subject property from 1903-1916 (upper left), 1927 (upper middle) and 1927-1963 (upper right). View of the façade, 1987 (lower left) and 2023 (lower right). Source: Library of Congress, Sanborn Fire Insurance Company, and Montgomery Planning.

¹ *Evening Star*, September 22, 1923.

² For more information, see HAWP 37/3-10AAA approved by the HPC on September 22, 2010. <https://mcatlas.org/filetransfer/HistoricPreservation/Temp%20Files/I.H%20-%207019%20Eastern%20Avenue,%20Takoma%20Park.PDF>

Proposal – Solar Installation

Staff finds that the solar installation meets the applicable guidelines and recommends approval. The HPC and staff utilize *Policy Guidance #20-01: Solar Technology (2021)* as the baseline for their review and to articulate their findings in the review of solar technology. The policy outlines the most to least preferred locations for solar arrays. The most preferred location for solar collection systems is a freestanding array in the rear yard, but this location is not feasible at the subject property due to the size of the lot and existing tree canopy. The second preferred location is a roof-mounted array on an accessory or non-historic building. There are no accessory buildings located on this property.

The third preferred location is a roof-mounted array on a non-historic addition of the main house. The applicant proposed two arrays consisting of five (5) panels and four (4) panels on the northern and south slopes, respectively, of the non-historic rear addition built in 2010 (*Figure 3*). This location would not be able to accommodate any additional panels due to its limited size. These solar panels would not be visible from the public rights-of-way. Therefore, staff recommends approval of this array as it complies with *Policy Guidance #20-01: Solar Technology (2021)*.



Figure 3: Aerial view showing the rear and side elevations of the subject house. The red arrows point to the locations of the two proposed arrays on the non-historic addition constructed in 2010. Source: ConnectExplorer.

The least preferred location is a roof-mounted array on the historic house. The applicant proposes to install four (4) panels on the southern slope of the original two-story, front-gable roof (*Figure 4*). While visibility is obscured presently due to the wooded nature of the lot, the panels would be partially visible absent vegetation when traveling northwest on Eastern Avenue. The existing brick chimney, however, would obscure a portion of the panels. The roof slope is not a character defining features of the streetscape. In addition, the subject property is on the edge of the historic district and opposite the Takoma Park Metro Station (Washington, D.C.), which limits the impact of any adverse effect of the panels to the surrounding viewsheds. Lastly, obfuscation of the asphalt shingles would not diminish the integrity of the individual resource. Therefore, staff recommends approval of this array as it complies with *Policy Guidance #20-01: Solar Technology (2021)*.



Figure 4: Aerial view showing the rear and side elevations of the subject house. The red arrows point to the locations of the single proposed array on the historic house.

Source: ConnectExplorer.

Staff finds that the proposal meets the general guidelines outlined in *Policy Guidance #20-01: Solar Technology (2021)* for traditional roof-mounted solar panels and recommends approval. The panels: 1) have a low profile and are mounted five inches above the surface of the roof (to the face of the panel); 2) are consistent with the existing slope; 3) are setback from the edges and ridges of the roof; and 4) are arranged in an organized configuration.

In addition, all conduit wires are located within the attic except for a section of the house that consists of a vaulted ceiling where interior installation is not feasible. This exterior conduit would run on the southern slope of an addition and would have limited visibility. All associated hardware/equipment would be located towards the rear of the house. The property owner (current or future) could remove the proposed solar panels and all associated equipment at a later date without impairing the integrity of the historic house or district. Therefore, recommends approval of the project as it complies with the *Standards*.



While there are five Outstanding Resources in the same block, none of these resources directly adjoin the subject property (*Figure 5*). Staff finds that the proposed panels would not adversely affect the viewsheds from these resources or surrounding streetscape. In addition, staff requested the applicant submit a glare study that confirmed no adverse effects to the surrounding buildings.

Figure 5: Aerial view showing the subject property outlined in blue and the surrounding Outstanding resources (marked with a red "x").

After full and fair consideration of the applicant's submission, staff finds the proposal, as modified by the condition, consistent with the Criteria for Issuance in Chapter 24A-8(b), (1), (2), and (d), having found the proposal is consistent with *the Secretary of the Interior's Standards for Rehabilitation #2, #9, and #10, Takoma Park Historic District Guidelines*, and the HPC's Policy No. 20-01 as outlined above.

STAFF RECOMMENDATION

Staff recommends that the Commission **approve** the HAWP application under the Criteria for Issuance in Chapter 24A-8(b), (1), (2), and (d), having found that the proposal, as modified by the condition, is consistent with the *Takoma Park Historic District Guidelines*, and therefore will not substantially alter the exterior features of the historic resource and is compatible in character with the district and the purposes of Chapter 24A;

and in conformance with *HPC Policy No. 20-01*;

and with the *Secretary of the Interior's Standards for Rehabilitation #2, #9 and #10*.

and with the general condition that the applicant shall present an electronic set of drawings, if applicable, to Historic Preservation Commission (HPC) staff for review and stamping prior to submission for the Montgomery County Department of Permitting Services (DPS) building permits;

and with the general condition that final project design details, not specifically delineated by the Commission, shall be approved by HPC staff or brought back to the Commission as a revised HAWP application at staff's discretion;

and with the general condition that the applicant shall notify the Historic Preservation Staff if they propose to make any alterations to the approved plans. Once the work is completed the applicant will contact the staff person assigned to this application at 301-563-3400 or john.liebertz@montgomeryplanning.org to schedule a follow-up site visit.



APPLICATION FOR HISTORIC AREA WORK PERMIT
HISTORIC PRESERVATION COMMISSION
301.563.3400

FOR STAFF ONLY:
HAWP#
DATE ASSIGNED

APPLICANT:

Name:
Address:
Daytime Phone:
E-mail:
City:
Zip:
Tax Account No.:

AGENT/CONTACT (if applicable):

Name:
Address:
Daytime Phone:
E-mail:
City:
Zip:
Contractor Registration No.:

LOCATION OF BUILDING/PREMISE: MIHP # of Historic Property

Is the Property Located within an Historic District? Yes/District Name
No/Individual Site Name

Is there an Historic Preservation/Land Trust/Environmental Easement on the Property? If YES, include a map of the easement, and documentation from the Easement Holder supporting this application.

Are other Planning and/or Hearing Examiner Approvals /Reviews Required as part of this Application? (Conditional Use, Variance, Record Plat, etc.?) If YES, include information on these reviews as supplemental information.

Building Number: Street:

Town/City: Nearest Cross Street:

Lot: Block: Subdivision: Parcel:

TYPE OF WORK PROPOSED: See the checklist on Page 4 to verify that all supporting items for proposed work are submitted with this application. Incomplete Applications will not be accepted for review. Check all that apply:

- New Construction
Addition
Demolition
Grading/Excavation
Deck/Porch
Fence
Hardscape/Landscape
Roof
Shed/Garage/Accessory Structure
Solar
Tree removal/planting
Window/Door
Other:

I hereby certify that I have the authority to make the foregoing application, that the application is correct and accurate and that the construction will comply with plans reviewed and approved by all necessary agencies and hereby acknowledge and accept this to be a condition for the issuance of this permit.

Signature of owner or authorized agent

Date

HAWP APPLICATION: MAILING ADDRESSES FOR NOTIFYING
[Owner, Owner's Agent, Adjacent and Confronting Property Owners]

Owner's mailing address	Owner's Agent's mailing address
Adjacent and confronting Property Owners mailing addresses	

Description of Property: Please describe the building and surrounding environment. Include information on significant structures, landscape features, or other significant features of the property:

Description of Work Proposed: Please give an overview of the work to be undertaken:

Work Item 1: _____	
Description of Current Condition:	Proposed Work:

Work Item 2: _____	
Description of Current Condition:	Proposed Work:

Work Item 3: _____	
Description of Current Condition:	Proposed Work:

**HISTORIC AREA WORK PERMIT
CHECKLIST OF
APPLICATION REQUIREMENTS**

	Required Attachments						
Proposed Work	I. Written Description	2. Site Plan	3. Plans/ Elevations	4. Material Specifications	5. Photographs	6. Tree Survey	7. Property Owner Addresses
New Construction	*	*	*	*	*	*	*
Additions/ Alterations	*	*	*	*	*	*	*
Demolition	*	*	*		*		*
Deck/Porch	*	*	*	*	*	*	*
Fence/Wall	*	*	*	*	*	*	*
Driveway/ Parking Area	*	*		*	*	*	*
Grading/Excavation/ Landscaping	*	*		*	*	*	*
Tree Removal	*	*		*	*	*	*
Siding/ Roof Changes	*	*	*	*	*		*
Window/ Door Changes	*	*	*	*	*		*
Masonry Repair/ Repoint	*	*	*	*	*		*
Signs	*	*	*	*	*		*

Fwd: 7019 Eastern Ave application for solar panel installation

1 message

Luisa Yared <lyared@luminasolar.com>
To: Olajumoke Carew <ocarew@luminasolar.com>

Thu, Sep 14, 2023 at 3:03 PM

Hi Ola,

Here we have the second approval for Sabrina Eaton.

Best regards,



Luisa Yared
Project Support Coordinator
443.304.7282
443.562.5220
luminasolar.com
3600 Commerce Dr, Ste 601
Baltimore, MD 21227

**Leave us a review!**

----- Forwarded message -----

From: **PETER FEIDEN** <petefeiden@aol.com>
Date: Wed, Sep 13, 2023 at 7:34 PM
Subject: Re: 7019 Eastern Ave application for solar panel installation
To: Sabrina Eaton <sabrinaeaton@gmail.com>
Cc: Alex Ticu <alex@luminasolar.com>, Luisa Yared <lyared@luminasolar.com>

This is all ok with me.

Sent from my iPhone

On Sep 13, 2023, at 6:58 PM, Sabrina Eaton <sabrinaeaton@gmail.com> wrote:To: Peter Feiden, [7025 Eastern Ave., Takoma Park, MD 20912](#)

Hi Peter. I signed a contract to have Lumina Solar install solar panels on my southeast facing roofs. The work is supposed to happen in a few months. Before that work can occur, Lumina Solar needs to get a Historic Area Work Permit (HAWP) from Montgomery County. As part of that application, the solar company asked me to confirm that the solar panel installation is OK with neighbors. If this is OK with you, would it be possible for you to hit "reply all" on this email and say it is OK? It is CC:ed to the solar installation company people who are handling the job. They will send your approval email to the Historic Area Work Permit issuers with the application.

I appreciate your help with this. Let me know if you have any questions.

Thanks,

Sabrina Eaton, 7019 Eastern Ave., Takoma Park, MD 20912
Cell – 202-841-1891

Fwd: Solar panel installation application for 7019 Eastern Ave

2 messages

Luisa Yared <lyared@luminasolar.com>
To: Olajumoke Carew <ocarew@luminasolar.com>

Thu, Sep 14, 2023 at 3:03 PM

Hi Ola!

Here we have 1 approval for Sabrina Eaton.

Best regards,



Luisa Yared
Project Support Coordinator
443.304.7282
443.562.5220
luminasolar.com
3600 Commerce Dr, Ste 601
Baltimore, MD 21227



Leave us a review!

----- Forwarded message -----

From: **Ray Martone** <rmartone@gmail.com>
Date: Wed, Sep 13, 2023 at 7:11 PM
Subject: Re: Solar panel installation application for 7019 Eastern Ave
To: Sabrina Eaton <sabrinaeaton@gmail.com>
Cc: Alex Ticu <alex@luminasolar.com>, Luisa Yared <lyared@luminasolar.com>

OK

On Wed, Sep 13, 2023 at 7:08 PM Sabrina Eaton <sabrinaeaton@gmail.com> wrote:
To: Ray Martone, [7108 Cedar Ave., Takoma Park, MD 20912](#)

Hi Ray. I signed a contract to have Lumina Solar install solar panels on my roof. The work is supposed to happen in a few months. Before that work can occur, Lumina Solar needs to get a Historic Area Work Permit (HAWP) from Montgomery County. As part of that application, the solar company asked me to confirm that the solar panel installation is OK with neighbors. If this is OK with you, would it be possible for you to hit "reply all" on this email and say it is OK? It is CC:ed to the solar installation company people who are handling the job. They will send your approval email to the Historic Area Work Permit issuers with the application.

I appreciate your help with this. Let me know if you have any questions.

Thanks,

Sabrina Eaton, [7019 Eastern Ave., Takoma Park, MD 20912](#)
Cell – 202-841-1891

Olajumoke Carew <ocarew@luminasolar.com>
To: Luisa Yared <lyared@luminasolar.com>

Thu, Sep 14, 2023 at 3:33 PM

Awesome, thank you so much!

[Quoted text hidden]



AOstructures Inc.
PO Box 413
Carnelian Bay, CA 96140
916.541.8586
www.AOstructures.com

Project: Eaton Residence Property Owner Mr.s &/or Mrs. Eaton

Address: 7019 Eastern Ave. NW., Takoma Park, MD. 20912

I reviewed the design of the photovoltaic (PV) system, as designed by the manufacturer, and the design criteria utilized for the mounting equipment and panel mounting assembly (rack system) for the installation of (13) panels supported by the rack system, as shown on the drawings prepared for the above referenced address. I certify that the configurations and design criteria meet the standards and requirements of the International Residential Code (IRC) and International Existing Building Code (IEBC) adopted by Montgomery County in COMCOR 08.00.02.

The attachment of the rack system to the building at the above address, including the location, number, and type of attachment points; the number of fasteners per attachment point; and the specific type of fasteners (size, diameter, length, minimum embedment into structural framing, etc.) meets the standards and requirements of the IRC and IEBC adopted by Montgomery County in COMCOR 08.00.02.

I evaluated the existing roof structure of the building at the above address and analyzed its capacity to support the additional loads imposed by the PV system. I certify that no structural modifications of the existing roof structure are required. The existing roof structure meets the standards and requirements of the IRC and IEBC, adopted by Montgomery County in COMCOR 08.00.02, necessary to support the PV system.

I evaluated the existing roof structure of the building at the above address and analyzed its capacity to support the additional loads imposed by the PV system. Structural modifications of the existing roof structure are required. I certify that the roof structure, as modified on the drawings for this project, will support the additional loads imposed by the PV system. I further certify that design of the modified roof structure meets the standards and requirements of the IRC and IEBC, adopted by Montgomery County in COMCOR 08.00.02.

I prepared or approved the construction documents for the mounting equipment, rack system, roof structure for this project.

49910
Maryland PE License Number

Date: 9/6/2023

DocuSigned by:
Andrew Oesterreicher
4A8006A02EA947F...

Seal



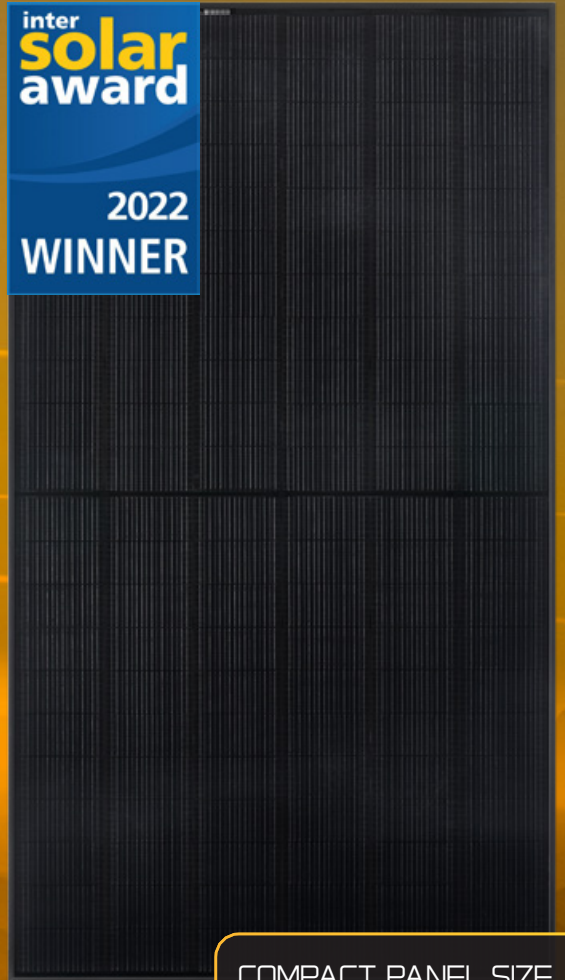
Professional Certification: I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 49910 Expires: 9/15/24

SOLAR'S MOST TRUSTED



inter solar award

2022 WINNER



COMPACT PANEL SIZE

REC ALPHA[®] PURE SERIES

PRODUCT SPECIFICATIONS

410 WP
222 W/M²



ELIGIBLE

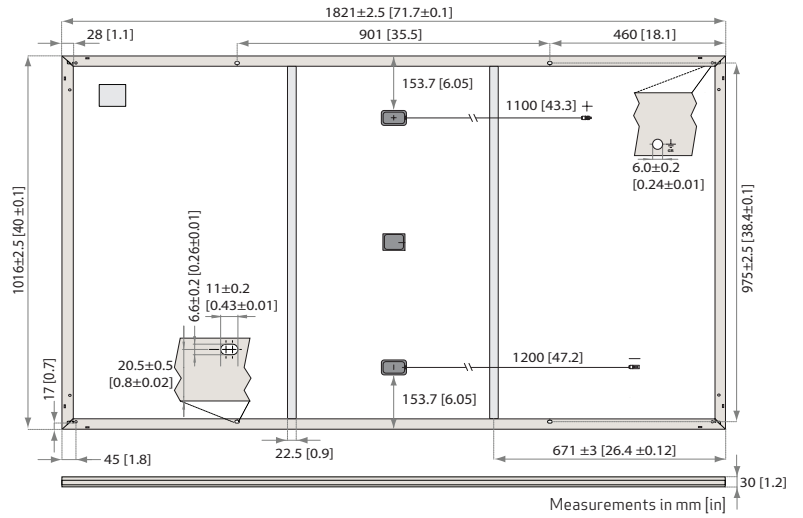


REC ALPHA PURE SERIES

PRODUCT SPECIFICATIONS

GENERAL DATA

Cell type:	132 half-cut REC heterojunction cells with lead-free, gapless technology, 6 strings of 22 cells in series
Glass:	3.2 mm solar glass with anti-reflective surface treatment in accordance with EN 12150
Backsheet:	Highly resistant polymer (black)
Frame:	Anodized aluminum (black)
Junction box:	3-part, 3 bypass diodes, lead-free IP68 rated, in accordance with IEC 62790
Connectors:	Stäubli MC4 PV-KBT4/KST4 (4 mm ²) in accordance with IEC 62852, IP68 only when connected
Cable:	4 mm ² solar cable, 1.1 m + 1.2 m in accordance with EN 50618
Dimensions:	1821 x 1016 x 30 mm (1.85 m ²)
Weight:	20.5 kg
Origin:	Made in Singapore



ELECTRICAL DATA

Product Code*: RECxxxAA Pure

	390	395	400	405	410
Power Output - P _{MAX} (Wp)	390	395	400	405	410
Watt Class Sorting - (W)	0/+5	0/+5	0/+5	0/+5	0/+5
Nominal Power Voltage - V _{MPP} (V)	40.6	41.0	41.4	41.8	42.2
Nominal Power Current - I _{MPP} (A)	9.61	9.64	9.67	9.69	9.72
Open Circuit Voltage - V _{OC} (V)	48.4	48.6	48.8	49.1	49.4
Short Circuit Current - I _{SC} (A)	10.38	10.39	10.40	10.41	10.42
Power Density (W/m ²)	211	214	216	219	222
Panel Efficiency (%)	21.1	21.4	21.6	21.9	22.2

	297	301	305	308	312
Power Output - P _{MAX} (Wp)	297	301	305	308	312
Nominal Power Voltage - V _{MPP} (V)	38.3	38.6	39.0	39.4	39.8
Nominal Power Current - I _{MPP} (A)	7.77	7.79	7.82	7.83	7.85
Open Circuit Voltage - V _{OC} (V)	45.6	45.8	46.0	46.3	46.6
Short Circuit Current - I _{SC} (A)	8.38	8.39	8.40	8.41	8.42

Values at standard test conditions (STC: air mass AM 1.5, irradiance 1000 W/m², temperature 25°C), based on a production spread with a tolerance of P_{MAX}, V_{OC} & I_{SC} ±3% within one watt class. Nominal module operating temperature (NMOT: air mass AM 1.5, irradiance 800 W/m², temperature 20°C, windspeed 1 m/s). * Where xxx indicates the nominal power class (P_{MAX}) at STC above.

MAXIMUM RATINGS

Operational temperature:	-40 ... +85°C
Maximum system voltage:	1000 V
Maximum test load (front):	+ 7000 Pa (713 kg/m ²)*
Maximum test load (rear):	- 4000 Pa (407 kg/m ²)*
Max series fuse rating:	25 A
Max reverse current:	25 A

* See installation manual for mounting instructions.
Design load = Test load / 1.5 (safety factor)

WARRANTY

	Standard	REC ProTrust
Installed by an REC Certified Solar Professional	No	Yes
System Size	All	≤25 kW 25-500 kW
Product Warranty (yrs)	20	25
Power Warranty (yrs)	25	25
Labor Warranty (yrs)	0	25
Power in Year 1	98%	98%
Annual Degradation	0.25%	0.25%
Power in Year 25	92%	92%

The REC ProTrust Warranty is only available on panels purchased through an REC Certified Solar Professional installer. Warranty conditions apply. See www.recgroup.com for more details.

CERTIFICATIONS

IEC 61215:2016, IEC 61730:2016, UL 61730	
IEC 62804	PID
IEC 61701	Salt Mist
IEC 62716	Ammonia Resistance
ISO 11925-2	Ignitability (Class E)
IEC 62782	Dynamic Mechanical Load
IEC 61215-2:2016	Hailstone (35mm)
IEC 62321	Lead-free acc. to RoHS EU 863/2015
ISO 14001, ISO 9001, IEC 45001, IEC 62941	



TEMPERATURE RATINGS*

Nominal Module Operating Temperature:	44°C (±2°C)
Temperature coefficient of P _{MAX} :	-0.24 %/°C
Temperature coefficient of V _{OC} :	-0.24 %/°C
Temperature coefficient of I _{SC} :	0.04 %/°C

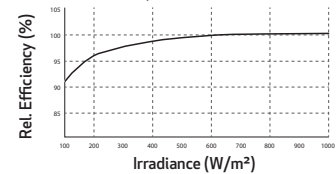
* The temperature coefficients stated are linear values

DELIVERY INFORMATION

Panels per pallet:	33
Panels per 40 ft GP/high cube container:	792 (24 pallets)
Panels per 13.6 m truck:	924 (28 pallets)
Panels per 53 ft truck:	891 (27 pallets)

LOW LIGHT BEHAVIOUR

Typical low irradiance performance of module at STC:



Available from:

Founded in 1996, REC Group is an international pioneering solar energy company dedicated to empowering consumers with clean, affordable solar power. As Solar's Most Trusted, REC is committed to high quality, innovation, and a low carbon footprint in the solar materials and solar panels it manufactures. Headquartered in Norway with operational headquarters in Singapore, REC also has regional hubs in North America, Europe, and Asia-Pacific.

REC Solar PTE. LTD.
20 Tuas South Ave. 14
Singapore 637312
post@recgroup.com
www.recgroup.com

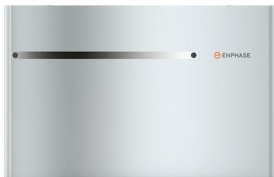


Declare.
Living Building
Challenge Compliant



IQ8 and IQ8+ Microinverters

Our newest IQ8 Microinverters are the industry’s first microgrid-forming, software-defined microinverters with split-phase power conversion capability to convert DC power to AC power efficiently. The brain of the semiconductor-based microinverter is our proprietary application-specific integrated circuit (ASIC) which enables the microinverter to operate in grid-tied or off-grid modes. This chip is built in advanced 55nm technology with high speed digital logic and has super-fast response times to changing loads and grid events, alleviating constraints on battery sizing for home energy systems.



Part of the Enphase Energy System, IQ8 Series Microinverters integrate with the Enphase IQ Battery, Enphase IQ Gateway, and the Enphase App monitoring and analysis software.



IQ8 Series Microinverters redefine reliability standards with more than one million cumulative hours of power-on testing, enabling an industry-leading limited warranty of up to 25 years.



Connect PV modules quickly and easily to IQ8 Series Microinverters using the included Q-DCC-2 adapter cable with plug-n-play MC4 connectors.



IQ8 Series Microinverters are UL Listed as PV Rapid Shut Down Equipment and conform with various regulations, when installed according to manufacturer’s instructions.

Easy to install

- Lightweight and compact with plug-n-play connectors
- Power Line Communication (PLC) between components
- Faster installation with simple two-wire cabling

High productivity and reliability

- Produce power even when the grid is down
- More than one million cumulative hours of testing
- Class II double-insulated enclosure
- Optimized for the latest high-powered PV modules

Microgrid-forming

- Complies with the latest advanced grid support
- Remote automatic updates for the latest grid requirements
- Configurable to support a wide range of grid profiles
- Meets CA Rule 21 (UL 1741-SA) requirements

IQ8 and IQ8+ Microinverters

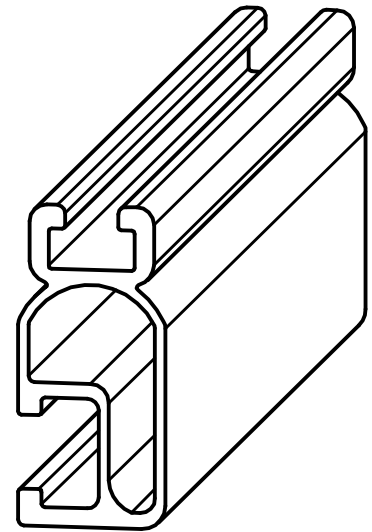
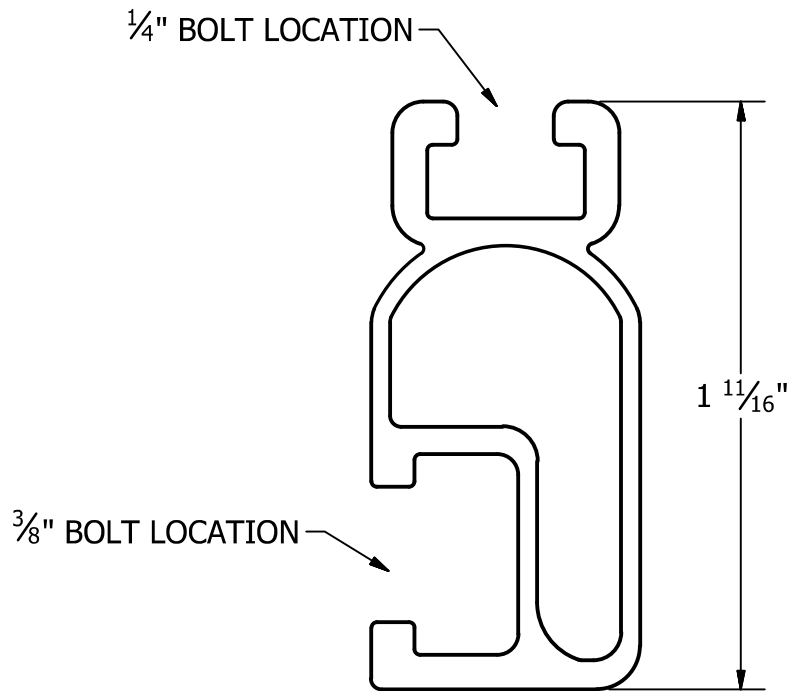
INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US
Commonly used module pairings ¹	W	235 – 350	235 – 440
Module compatibility		60-cell/120 half-cell	60-cell/120 half-cell and 72-cell/144 half-cell
MPPT voltage range	V	27 – 37	29 – 45
Operating range	V	25 – 48	25 – 58
Min/max start voltage	V	30 / 48	30 / 58
Max input DC voltage	V	50	60
Max DC current ² [module Isc]	A		15
Overvoltage class DC port			II
DC port backfeed current	mA		0
PV array configuration		1x1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit	
OUTPUT DATA (AC)		IQ8-60-2-US	IQ8PLUS-72-2-US
Peak output power	VA	245	300
Max continuous output power	VA	240	290
Nominal (L-L) voltage/range ³	V	240 / 211 – 264	
Max continuous output current	A	1.0	1.21
Nominal frequency	Hz	60	
Extended frequency range	Hz	50 – 68	
Max units per 20 A (L-L) branch circuit ⁴		16	13
Total harmonic distortion		<5%	
Overvoltage class AC port		III	
AC port backfeed current	mA	30	
Power factor setting		1.0	
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging	
Peak efficiency	%	97.5	97.6
CEC weighted efficiency	%	97	97
Night-time power consumption	mW	60	
MECHANICAL DATA			
Ambient temperature range		-40°C to +60°C (-40°F to +140°F)	
Relative humidity range		4% to 100% (condensing)	
DC Connector type		MC4	
Dimensions (HxWxD)		212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")	
Weight		1.08 kg (2.38 lbs)	
Cooling		Natural convection – no fans	
Approved for wet locations		Yes	
Acoustic noise at 1 m		<60 dBA	
Pollution degree		PD3	
Enclosure		Class II double-insulated, corrosion resistant polymeric enclosure	
Environ. category / UV exposure rating		NEMA Type 6 / outdoor	
COMPLIANCE			
Certifications		CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.	

(1) No enforced DC/AC ratio. See the compatibility calculator at <https://link.enphase.com/module-compatibility> (2) Maximum continuous input DC current is 10.6A (3) Nominal voltage range can be extended beyond nominal if required by the utility. (4) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

SPEC SHEET

Part #	Box Quantity
17660	4" QB2 (25)
17662	3" Microflashing® (25); 4" QB2 (25); L-Foot (25)





PART # TABLE		
P/N	DESCRIPTION	LENGTH
315168M	SM LIGHT RAIL 168" MILL	168"
315168D	SM LIGHT RAIL 168" DRK	168"
315240M	SM LIGHT RAIL 240" MILL	240"
315240D	SM LIGHT RAIL 240" DRK	240"



1411 BROADWAY BLVD, NE
 ALBUQUERQUE, NM 87102 USA
 PHONE: 505.242.6411
 WWW.UNIRAC.COM

PRODUCT LINE: SOLARMOUNT

DRAWING TYPE: PART DETAIL

DESCRIPTION: LIGHT RAIL

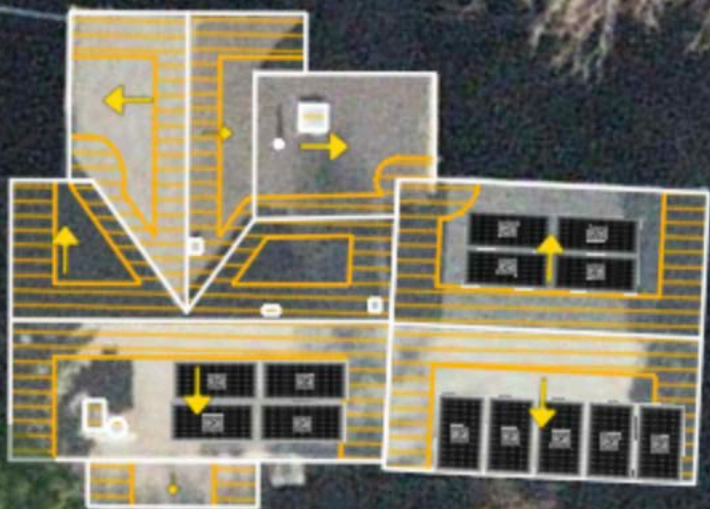
REVISION DATE: 9/11/2017

DRAWING NOT TO SCALE
 ALL DIMENSIONS ARE
 NOMINAL

PRODUCT PROTECTED BY
 ONE OR MORE US PATENTS
 LEGAL NOTICE

SM-P02

SHEET





SOLAR PV SYSTEM: 5.265 kWp

EATON RESIDENCE

7019 EASTERN AVENUE NORTHWEST
TAKOMA PARK MD USA 20912

PROJECT INFORMATION

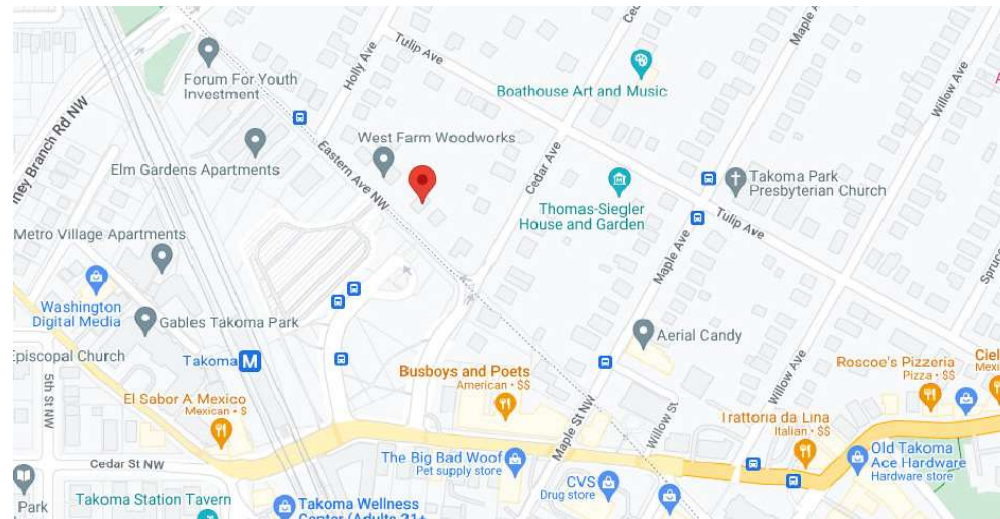
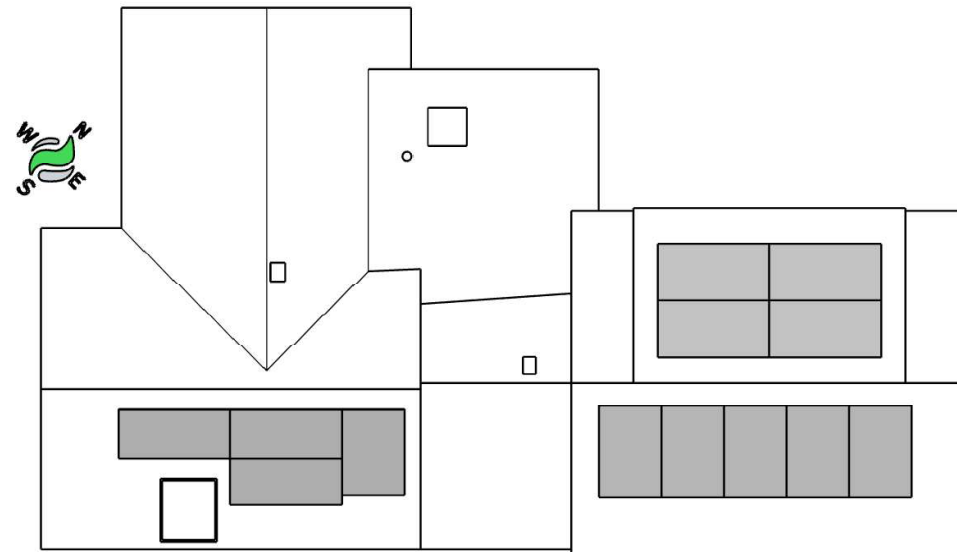
OWNER: SABRINA EATON
ADDRESS: 7019 EASTERN AVENUE
NORTHWEST TAKOMA PARK
MD USA 20912

AHJ: MONTGOMERY COUNTY (MD)
ADDRESS: 2425 REEDIE DRIVE
WHEATON-GLENMONT,
MARYLAND 20902

ZONING: RESIDENTIAL
BUILDING CODE: IBC 2018
ELECTRICAL CODE: NEC 2017
ASCE VERSION: ASCE 7-16

SNOW LOAD: 30 PSF
WIND SPEED: 115 MPH
WIND EXPOSURE: B

DC RATING: 5.265 kW
AC RATING: 3.77 kW
RACKING: UNIRAC SM LIGHT RAIL
MODULE: (13) REC405AA
INVERTER: (13) IQ8PLUS-72-2-US



PROJECT SCOPE

THIS PROJECT INVOLVES THE INSTALLATION OF (13) REC PURE 405W ALL BLACK SOLAR MODULES. THE SOLAR MODULES WILL BE RACKED USING A PRE-ENGINEERED RACKING SYSTEM. THE RACKED MODULES WILL BE ELECTRICALLY CONNECTED TO (13) ENPHASE DC TO AC POWER INVERTERS, AND INTERCONNECTED TO THE LOCAL UTILITY USING MEANS AND METHODS CONSISTENT WITH THE RULES ENFORCED BY THE LOCAL UTILITY AND PERMITTING JURISDICTION.

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PROJECT ADDRESS:

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NORTHWEST TAKOMA
PARK MD USA 20912

CONTRACTOR INFO:



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BALTIMORE, MD 21227
(443) 955-0779

LICENSE NUMBER:

MHIC-30991

REV	DATE
IFC	8/18/2023

COVER

Z001

INDEX OF PAGES	
Z001	COVER PAGE
A001	ATTACHMENT & SITE PLAN
S001	ASSEMBLY & LOAD CALCS
E001	ELECTRICAL - LINE DIAGRAM
E002	ELECTRICAL - WIRE CALCS
E003	STRING & CONDUIT LAYOUT
E004	EQUIP. RATINGS & SIGNAGE

GENERAL NOTES

1) THIS PHOTOVOLTAIC (PV) SYSTEM SHALL COMPLY WITH THE NATIONAL ELECTRIC CODE (NEC) ARTICLE 690, ALL MANUFACTURERS'S LISTING AND INSTALLATION INSTRUCTIONS, AND THE RELEVANT CODES AS SPECIFIED BY THE AUTHORITY HAVING JURISDICTION (AHJ).

2) ALL SIGNAGE TO BE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE AND AS REQUIRED BY THE NEC AND AHJ.

3) PV SYSTEM CIRCUITS INSTALLED ON OR IN BUILDINGS SHALL INCLUDE A RAPID SHUTDOWN FUNCTION TO REDUCE SHOCK HAZARD FOR EMERGENCY RESPONDERS

4) THIS SYSTEM IS A UTILITY INTERACTIVE SYSTEM, AND THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE.



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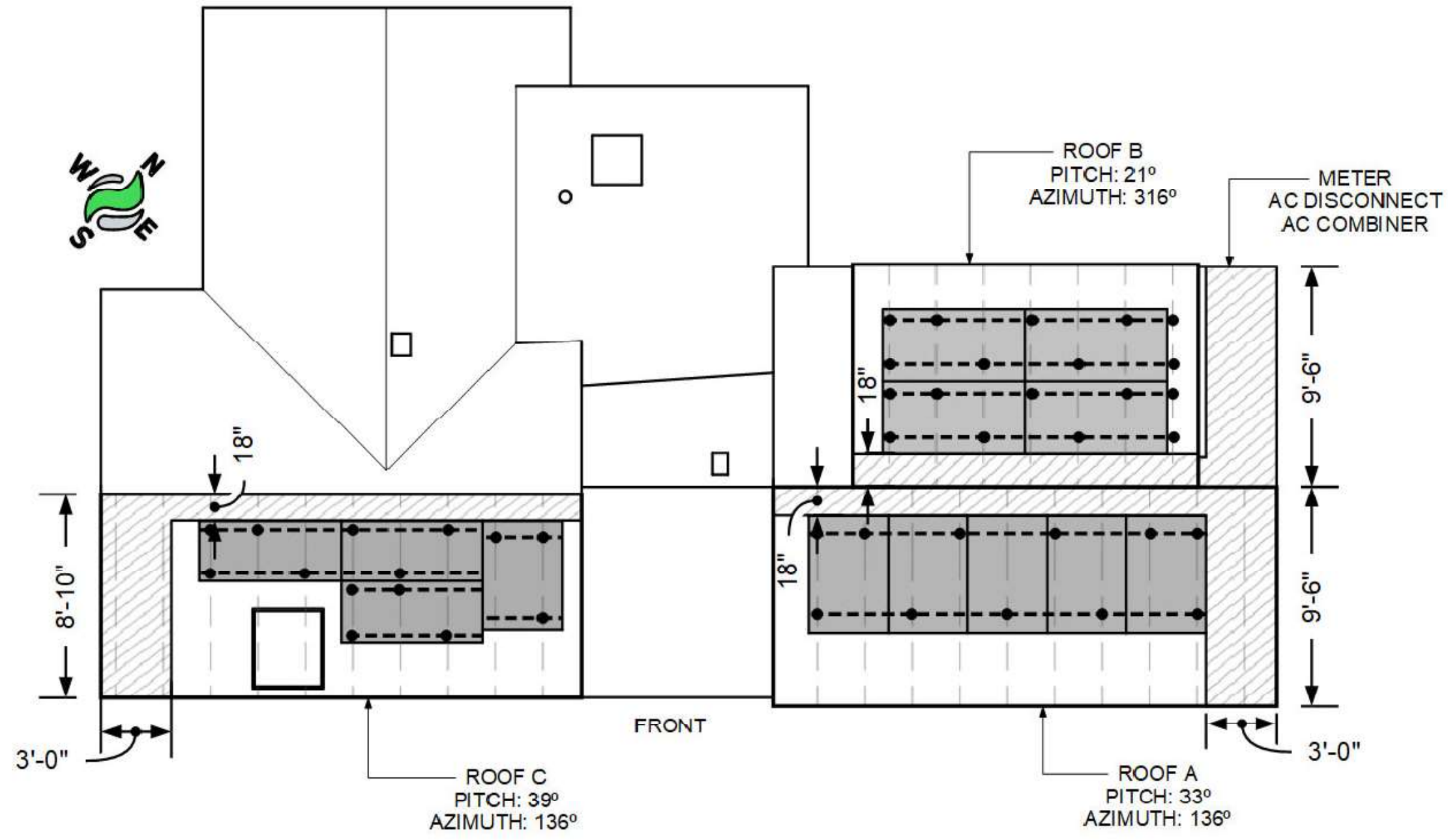
DocuSigned by:

Andrew Oesterreicher

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Professional Certification: I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland. License No. 4A8006A02EA947F Expires 8/13/26

FOR ENGINEERING USE ONLY



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LEGEND

- ROOF SUPPORT
- MOUNTING RAIL
- ROOF ATTACHMENT
- PV ARRAY
- FIRECODE SETBACK

PROJECT ADDRESS:

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ATTACHMENT PLAN

A001

INSTALLATION NOTES

- 1) ALL SOLAR MODULES SUPPORTED BY ROOF ATTACHMENTS STAGGERED AT 48 IN O.C. (OR AS INDICATED)
- 2) SOLAR PHOTOVOLTAIC SYSTEM INSTALLED PARALLEL TO ROOF SURFACE
- 3) SOLAR PHOTOVOLTAIC SYSTEM INSTALLED AT A MAXIMUM HEIGHT OF 6 IN ABOVE ROOF SURFACE (OR AS INDICATED)

4) ANY ROOFING PENETRATIONS SHALL HAVE PROPER FLASHING SEALANT USED TO PROVIDE WATERTIGHT ASSEMBLY

TOTAL ROOF PLAN AREA = 1415.32 SQ.FT.
 TOTAL SOLAR ARRAY AREA = 258.917 SQ.FT.
ARRAY ROOF COVERAGE = 19 %

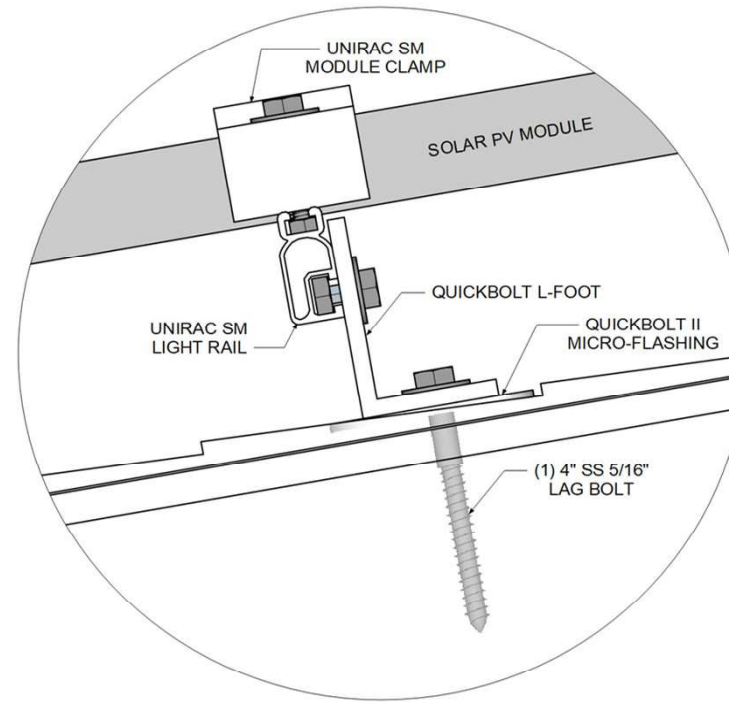
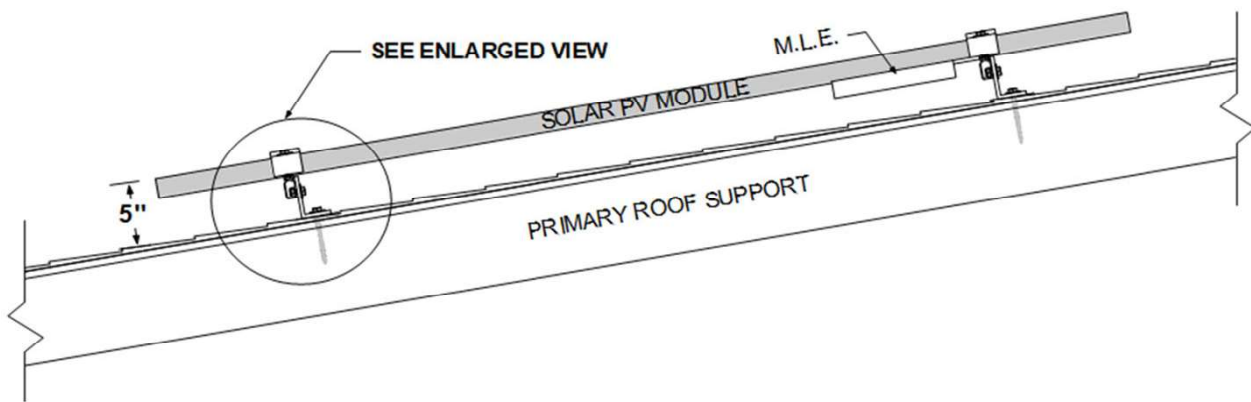


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Andrew Oesterreicher
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ASSEMBLY & LOAD CALCS

S001

ROOF PROPERTIES	ROOF LABEL:	A	B	C
	MATERIAL:	3-Tab Comp Shingle	3-Tab Comp Shingle	3-Tab Comp Shingle
	PITCH:	33°	21°	37°
	AZIMUTH:	136°	316°	136°
	PRIMARY SUPPORT:	2x10 RAFTERS	2x10 RAFTERS	2x4 TOP CHORD TRUSSES
	PRIMARY SUPPORT SPACING:	24"	24"	24"
	SPAN (EAVE TO RIDGE):	10'	10'	9'
	MEAN HEIGHT:	25'	25'	25'
	RACKING:	UNIRAC SM LIGHT RAIL	UNIRAC SM LIGHT RAIL	UNIRAC SM LIGHT RAIL
	STANDOFF:	QUICKBOLT	QUICKBOLT	QUICKBOLT
DEAD & POINT LOAD CALCULATIONS	NUMBER OF MODULES:	5	4	4
	MODULE WEIGHT (LBS):	225.00	180.00	180.00
	M.L.E. WEIGHT (LBS):	11.90	9.52	9.52
	RACKING WEIGHT (LBS):	48.40	38.72	38.72
	STANDOFF WEIGHT (LBS):	7.50	6.00	6.00
	ARRAY WEIGHT (LBS):	292.80	234.24	234.24
	ARRAY AREA (SQ.FT.):	99.58	79.67	79.67
	DISTRIBUTED LOAD (PSF):	2.94	2.94	2.94
	APPROX. NUMBER OF STANDOFFS:	13	10	10
	POINT LOAD (LBS/STANDOFF):	22.52	23.42	23.42

INSTALLATION NOTES

- 1) ALL RACKING SHALL BE INSTALLED PER MANUFACTURER SPECIFICATIONS
- 2) M.L.E.'S = MODULE LEVEL ELECTRONICS (IE, POWER OPTIMIZERS, MICRO-INVERTERS, CABLES, ETC)
- 3) USE 5/16" X 4"HEX HEAD STAINLESS STEEL LAG SCREWS

MOUNTING SYSTEM PROPERTIES	
RACKING	UNIRAC SM LIGHT RAIL
STANDOFF	QUICKBOLT TO PRIMARY SUPPORT
MAX. RAIL SPAN (IN)	48
MIN. FASTENER DEPTH (IN)	2.5
MAX. RAIL CANTILEVER (IN)	16
MAX. ARRAY HEIGHT (IN)	5



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CONDUCTOR AND CONDUIT SCHEDULE

TAG	WIRE SIZE	GROUND SIZE	WIRE TYPE	DESCRIPTION	CONDUIT SIZE	CONDUIT TYPE	LENGTH
SEU	#4/0 AL	N/A	SEU	(2) PHASE CONDUCTORS & (1) NEUTRAL	N/A	N/A	5'
A	#12 AWG	#6 AWG	Q-CABLE	(2) PHASE CONDUCTORS & (1) BARE COPPER IN FREE AIR	N/A	N/A	77' (MAX)
B	#10 AWG	#8 AWG	THWN-2	(2) PHASE CONDUCTORS & (1) GROUND	0.75"	EMT	37'
C	#10 AWG	#8 AWG	THWN-2	(2) PHASE CONDUCTORS & (1) NEUTRAL & (1) GROUND	0.75"	EMT	5'
D	#10 AWG	#8 AWG	THWN-2	(2) PHASE CONDUCTORS & (1) NEUTRAL & (1) GROUND	0.75"	EMT	5'

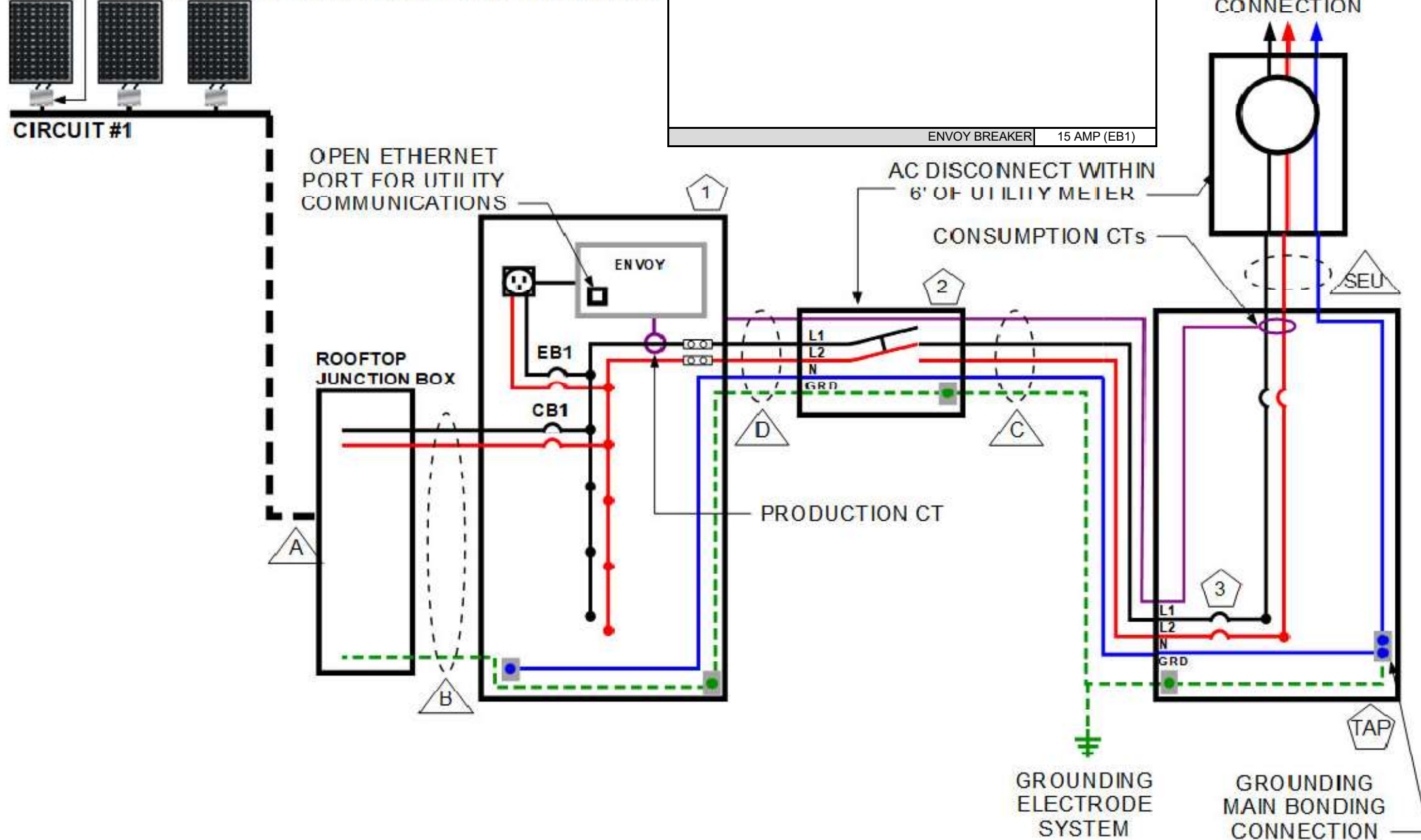
EQUIPMENT SCHEDULE

TAG	EQUIPMENT DETAILS	MOUNTING LOCATION
TAP	200 AMP EATON CH MAIN SERVICE PANEL WITH 200 AMP MAIN BREAKER (200 AMP SERVICE)	FLUSH-MOUNTED ON WALL OPPOSITE UTILITY METER
1	ENPHASE COMBINER (MODEL #X-IQ-AM1-240-4) WITH CIRCUITS AS LISTED IN TABLE	MOUNTED ADJACENT TO UTILITY METER
2	SERVICE RATED 30 AMP NEMA3R NON-FUSED DISCO (MODEL #DU221RB)	MOUNTED ADJACENT TO UTILITY METER
3	2 POLE, 20 AMP EATON CH MAIN SERVICE PANEL BREAKER	SOLAR PV BACKFED BREAKER IN MAIN SERVICE PANEL

CIRCUIT SCHEDULE

CIRCUIT	INVERTER COUNT	AMPERAGE CALCULATION	BREAKER SIZE
#1	13	13 x 1.21 x 125% = 19.66 A	20 AMP (CB1)
			ENVOY BREAKER 15 AMP (EB1)

SOLAR MODULE; SEE PAGE E004 FOR RATINGS
MICRO-INVERTER; SEE PAGE E004 FOR RATINGS



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PROJECT ADDRESS:

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ELECTRICAL - LINE DIAGRAM

E001

ELECTRICAL NOTES

WHEN THE AC UTILITY SOURCE IS REMOVED FROM THE INVERTER OUTPUT CIRCUITS VIA ANY MEANS, SUCH AS AN AC BREAKER, AC DISCONNECT, OR REMOVAL OF THE SOLAR OR MAIN UTILITY SERVICE METER, THIS EQUIPMENT PERFORMS THE RAPID SHUTDOWN FUNCTION PER 690.12

ARRAY BONDED WITH #6 BARE Cu

TWO UNGROUNDED CONDUCTORS PER CIRCUIT OF INVERTERS (TYP)

ALL CONDUIT SIZING WILL BE IN ACCORDANCE TO THE NEC, CHAPTER 9

PVC OR LFMC MAY BE USED INSTEAD OF EMT CONDUIT

THE AC DISCONNECT IS LOCKABLE, TAGGABLE, 24/7 UTILITY ACCESSIBLE, LOAD BREAK CAPABLE, AND HAS VISIBLE BREAK.

CALCULATION FOR PV BREAKER

SYSTEM CURRENT	1.21	x	13	=	15.73 A
DESIGN AMPERAGE (FLA)	15.73	x	125%	=	19.6625 A
MAIN BUSS RATING	200	x	120%	=	240 A
EXISTING MAIN BREAKER					200 A
MAX SOLAR BREAKER	240	-	200	=	40 A

ARRAY TO COMBINER	
WIRE LENGTH	37 FT
WIRE SIZE	#10 AWG
SYSTEM PROPERTIES	
FULL LOAD AMPERAGE	15.73
SOURCE VOLTAGE	240
LENGTH OF RUN (FT)	37
LOAD DUTY	CONTINUOUS
CONDUCTOR TYPE	THWN-2
CONDUCTOR MATERIAL	COPPER
CONDUCTOR LOCATION	DRY OR WET
CONDUCTOR INSULATION TEMP	75°C
DISTANCE ABOVE ROOF	ALL INTERIOR CONDUIT
AVERAGE OUTSIDE TEMP (°F)	94
TEMP ADDER (°F)	N/A
ADJUSTED AMBIENT TEMP (°F)	94
TERMINAL TEMP RATING	75°C
CIRCUIT TYPE	SINGLE PHASE 2-WIRE
QTY. OF CURRENT-CARRYING CONDUCTORS	2
ADDITIONAL CURRENT-CARRYING CONDUCTORS	
TOTAL # OF CURRENT-CARRYING CONDUCTORS	2
CONDUCTOR CONDITIONS OF USE	
LARGEST CIRCUIT FULL LOAD AMPS	15.73
LOAD DUTY MULTIPLIER	1.25
AMBIENT TEMP FACTOR	0.94
QTY. CONDUCTORS IN CONDUIT FACTOR	1.00
CONDUCTOR SELECTION	
MINIMUM REQUIRED CONDUCTOR AMPACITY	20.92
SELECTED CONDUCTOR AMPACITY	35.00
SELECTED CONDUCTOR SIZE (AWG)	10
TERMINAL REQUIREMENT	
LARGEST CIRCUIT FULL LOAD AMPS	15.73
LOAD DUTY MULTIPLIER	1.25
REQUIRED TERMINAL AMPACITY	19.66
VOLTAGE DROP	
OHMS/MILFT	1.240
LENGTH OF RUN (FT)	37
LOAD CURRENT	15.73
VOLTAGE DROP	1.44
VOLTS AT LOAD TERMINAL	238.56
PERCENT VOLTAGE DROP	0.61%

INTERCONNECTION	
METHOD	BREAKER TAP
WIRE SIZE	#10 AWG
SYSTEM PROPERTIES	
FULL LOAD AMPERAGE	15.73
SOURCE VOLTAGE	240
LENGTH OF RUN (FT)	15
LOAD DUTY	CONTINUOUS
CONDUCTOR TYPE	THWN-2
CONDUCTOR MATERIAL	COPPER
CONDUCTOR LOCATION	DRY OR WET
CONDUCTOR INSULATION TEMP	75°C
AMBIENT TEMP	26-30°C
TERMINAL TEMP RATING	75°C
CIRCUIT TYPE	SINGLE PHASE 3-WIRE
QTY. OF CURRENT-CARRYING CONDUCTORS	2
CONDUCTOR CONDITIONS OF USE	
FULL LOAD AMPS	15.73
LOAD DUTY MULTIPLIER	1.25
AMBIENT TEMP FACTOR	1.00
QTY. CONDUCTORS IN CONDUIT FACTOR	1.00
CONDUCTOR SELECTION	
MINIMUM REQUIRED CONDUCTOR AMPACITY	19.66
SELECTED CONDUCTOR AMPACITY	35.00
SELECTED CONDUCTOR SIZE (AWG)	10
TERMINAL REQUIREMENT	
FULL LOAD AMPS	15.73
LOAD DUTY MULTIPLIER	1.25
REQUIRED TERMINAL AMPACITY	19.66
VOLTAGE DROP	
OHMS/MILFT	1.240
LENGTH OF RUN (FT)	15
LOAD CURRENT	15.73
VOLTAGE DROP	0.59
VOLTS AT LOAD TERMINAL	239.41
PERCENT VOLTAGE DROP	0.24%

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PROJECT ADDRESS:

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ELECTRICAL - WIRE CALCS

E002

ELECTRICAL NOTES

1) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 75°C AND WET ENVIRONMENT, UNLESS OTHERWISE NOTED.

2) ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.

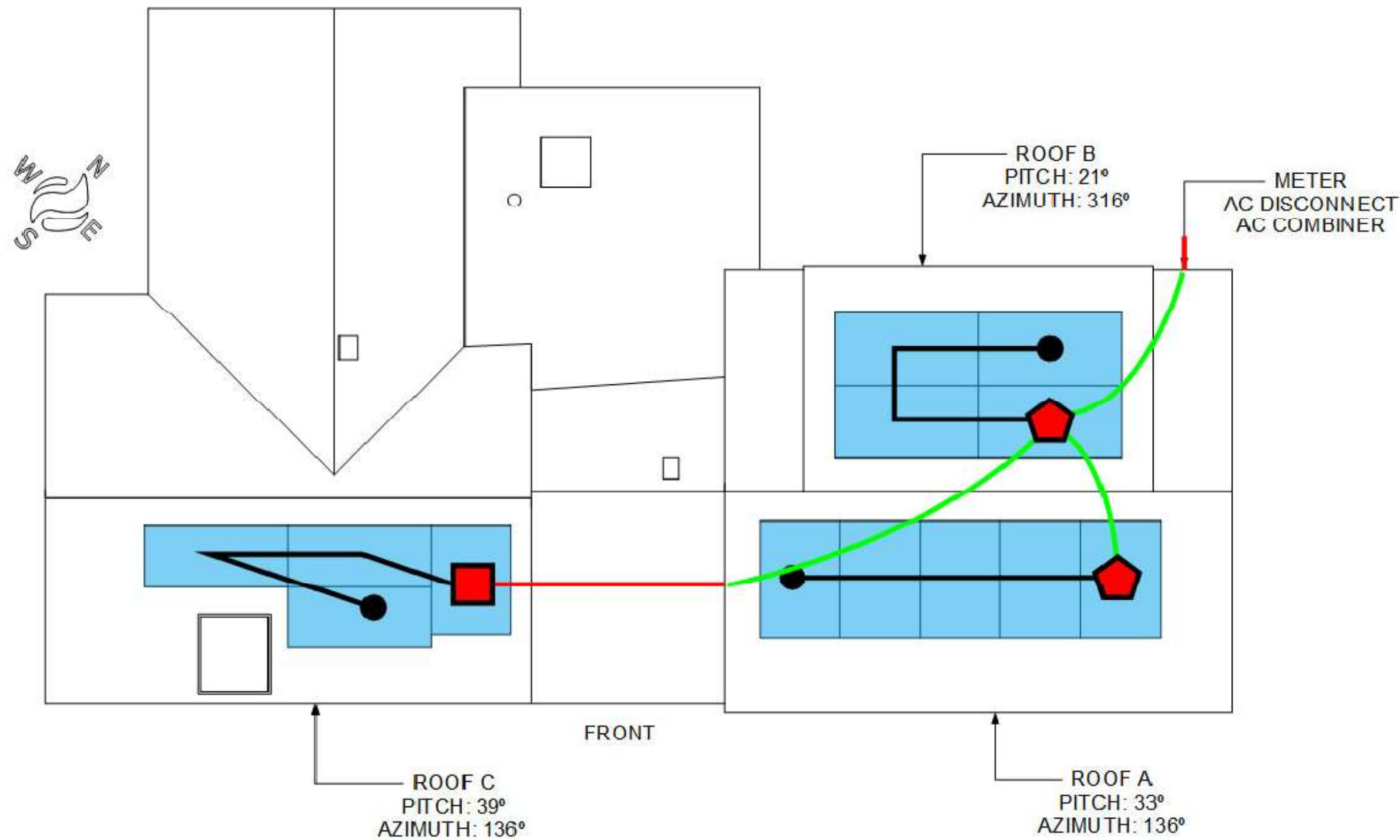
3) MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER MANUFACTURER'S INSTRUCTION.

LEGEND

- JUNCTION BOX
- SOLADECK
- END CAP
- EXTERIOR CONDUIT
- INTERIOR CONDUIT
- BASEMENT CONDUIT
- TRUNK CABLE

COLOR	CIRCUIT	MODULE COUNT
	#1	13

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CIRCUIT & CONDUIT LAYOUT

E003

SOLAR MODULE RATINGS		
REC Pure 405w All Black Specifications		
Length:	71.7	in
Width:	40	in
Thickness:	1.2	in
Weight:	45.00	lbs
Imp:	9.56	A
Vmp:	42.4	V
Voc:	48.9	V
Isc:	10.14	A
OCPD:	25	A
Pmax:	405	W
Vmax:	1000	V
Temp. Coefficient:	-0.24	%Voc/°C

INVERTER 1 RATINGS	
Enphase IQ8+ Specifications	
Max # Per String:	13
I _{max} (ac):	1.21 A
V _{max} (dc):	60 V
P _{max} :	290 W
Nom. AC Voltage:	240 V
OCPD:	20 A
Weight (Optimizer):	2.38 lbs
I _{max} (Input):	15 A
P _{max} (dc) Input:	440 V

WARNING: PHOTOVOLTAIC POWER SOURCE

LABEL TO BE INSTALLED AT EXPOSED RACEWAYS, CABLE TRAYS, AND OTHER WIRING METHODS; SPACED AT MAXIMUM 10FT SECTION OR WHERE SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS, OR FLOORS.

LETTERS AT LEAST 3/8 INCH; WHITE ON RED BACKGROUND; REFLECTIVE

PHOTOVOLTAIC DC DISCONNECT

LABEL TO BE INSTALLED AT EACH DC DISCONNECTING MEANS

PHOTOVOLTAIC AC DISCONNECT

LABEL TO BE INSTALLED AT EACH AC DISCONNECTING MEANS

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

LABEL TO BE INSTALLED AT RAPID SHUTDOWN SWITCH

LETTERS AT LEAST 3/8 INCH; WHITE ON RED BACKGROUND; REFLECTIVE

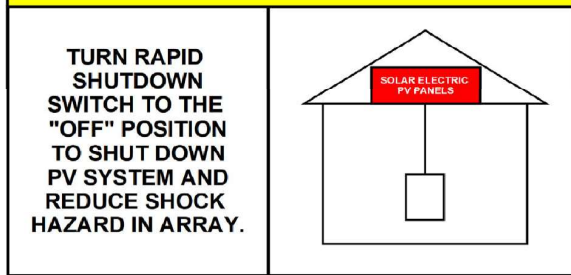
SOLAR PV SYSTEM DISCONNECT

RATED AC OUTPUT CURRENT: 15.73 A

NOMINAL OPERATING AC VOLTAGE: 240 V

LABEL TO BE INSTALLED AT AN ACCESSIBLE LOCATION AT THE DISCONNECTING MEANS AS A POWER SOURCE

SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN



LABEL TO BE INSTALLED ON NO MORE THAN 3FT FROM THE SERVICE DISCONNECTING MEANS

WARNING

ELECTRICAL SHOCK HAZARD

DO NOT TOUCH TERMINALS! TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

LABEL TO BE INSTALLED AT EACH DISCONNECTING MEANS FOR PHOTOVOLTAIC EQUIPMENT

WARNING

ELECTRICAL SHOCK HAZARD

IF GROUND FAULT IS INDICATED NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED

LABEL TO BE INSTALLED AT EACH DISCONNECTING MEANS FOR PHOTOVOLTAIC EQUIPMENT

WARNING

DUAL POWER SOURCE SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

WARNING

INVERTER OUTPUT CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE

INTERACTIVE PHOTOVOLTAIC SYSTEM CONNECTED

LABEL TO BE INSTALLED AT UTILITY METER

SOLAR PV LOADCENTER
5.265 kW DC SOLAR ARRAY

240 VOLT AC SYSTEM

INSTALLED COMPONENTS
(13) REC Pure 405w All BlackW Modules
(13) Enphase IQ8+

EMERGENCY CONTACT
LUMINA SOLAR: 800-971-6118

CIRCUIT CALCULATIONS

SYSTEM CURRENT:	1.21	x	13	=	15.73 A
DESIGN AMPERAGE:	15.73	x	125%	=	19.6625 A
CIRCUIT #1 =	13		15.73		19.66

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL TO BE INSTALLED ON OR NO MORE THAN 3FT FROM THE RAPID SHUTDOWN SWITCH

SIGNAGE NOTES

- 1) ALL PLAQUES AND LABELS SHALL HAVE A RED BACKGROUND (OR AS SHOWN HERE)
- 2) ALL LETTERING SHALL BE WHITE AND HAVE A MINIMUM HEIGHT OF 3/8" (OR AS SHOWN HERE)
- 3) FONT SHALL BE ARIAL (OR SIMILAR) AND ALL LETTERING SHALL BE CAPITALIZED
- 4) ALL PLAQUES AND LABELS SHALL BE OF A MATERIAL SUITABLE FOR THE ENVIRONMENT INSTALLED

FOR PERMITTING USE ONLY

PROJECT ADDRESS:

SABRINA EATON
7019 EASTERN AVENUE
NORTHWEST TAKOMA
PARK MD USA 20912

CONTRACTOR INFO:



FUSION SOLAR SERVICES

3600 COMMERCE DR
SUITE 601
BALTIMORE, MD 21227
(443) 955-0779

LICENSE NUMBER:

MHIC-30991

REV	DATE
IFC	8/18/2023

IFC 8/18/2023

EQUIP. RATINGS & SIGNAGE

E004



AOstructures Inc.
 PO Box 413
 Carnelian Bay, CA 96140
 916.541.8586
 www.AOstructures.com

September 8, 2023

TO: Lumina Solar

SUBJECT: Roof-top Solar PV Addition - Eaton Residence
 7019 Eastern Ave. NW., Takoma Park, MD. 20912

SCOPE OF WORK:

AOstructures, Inc. was asked to provide a structural review for the project at the above subject location. The scope of this report is strictly limited to the items listed below and based on the design criteria listed below. See additional limitations in Appendix B.

- Analyze the existing structure(s) to see if it is/they are suitable to support the additional weight of the proposed roof mounted solar PV system.
- Evaluate the connection capacity of the proposed racking system to the existing roof structure.

PROVIDED INFORMATION:

As-built plans were not provided for our review. The findings of this report are based upon a jobsite evaluation of the existing condition of the existing framing system collected by Lumina Solar as requested by AOstructures, Inc.. All attached structural calculations are based on the provided information and are only deemed valid if the provided information is true and accurate.

OBSERVED CONDITIONS:

The observed roof framing is described below. If field conditions differ, the contractor shall notify the engineer prior to starting construction.

The roof structure of (Roof's A & B) consists of composition shingle on roof plywood that is supported by 2x10 rafters @ 24"o.c.. The rafters support a vaulted ceiling and have a max projected horizontal span of 9'-0", with a slope of 37 degrees. The rafters are supported at the ridge by a ridge beam and at the eave by a load bearing wall.

The roof structure of (Roof C) consists of composition shingle on 1x decking that is supported by nominal 2"x4" rafters @ 24"o.c., paired with ceiling joists acting as rafter ties. The rafters are supported by vertical struts which transfer gravity loads to the ceiling joists below. The rafters have a max projected horizontal span of 8'-0", with a slope of 21 degrees. The rafters are connected at the ridge to a ridge board and are supported at the eave by a load bearing wall.

CONCLUSIONS:

The existing roof framing members of (All Roof's) are judged to be adequate to withstand the loading imposed by the installation of the solar panels. No structural retrofits are required.

The spacing of the solar standoffs shall not exceed 48" o.c. and be staggered. All racking hardware shall be installed per manufacturer specifications and utilized within the manufacturers design limitations based on the design criteria of this report. AOstructures, Inc. assumes no responsibility for hardware installed outside the design & install specifications of the manufacturer. All waterproofing shall be provided by the contractor.

DESIGN CRITERIA:

- Applicable Codes = 2018 IBC/IRC, ASCE 7-16
- 72 cell solar PV modules w/ a flush mounted rail based racking system
- Roof Dead Load = 13 psf (Roof's A & B) -- 14 psf (Roof C)
- Roof Live Load = 20 psf
- Wind Speed = 115 mph, Exposure B, Risk Category II
- Ground Snow Load = 30 psf - Roof Snow Load = 21 psf
- Per IBC 1613.1; Seismic check is not required

Please contact me with any further questions or concerns regarding this project.

Sincerely,

Andrew Oesterreicher, P.E.
 Project Engineer

DocuSigned by:

Andrew Oesterreicher

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Professional Certification: I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
 License No. 49910 Expires: 9/15/24

Eaton, Sabrina, Takoma Park, MD 1



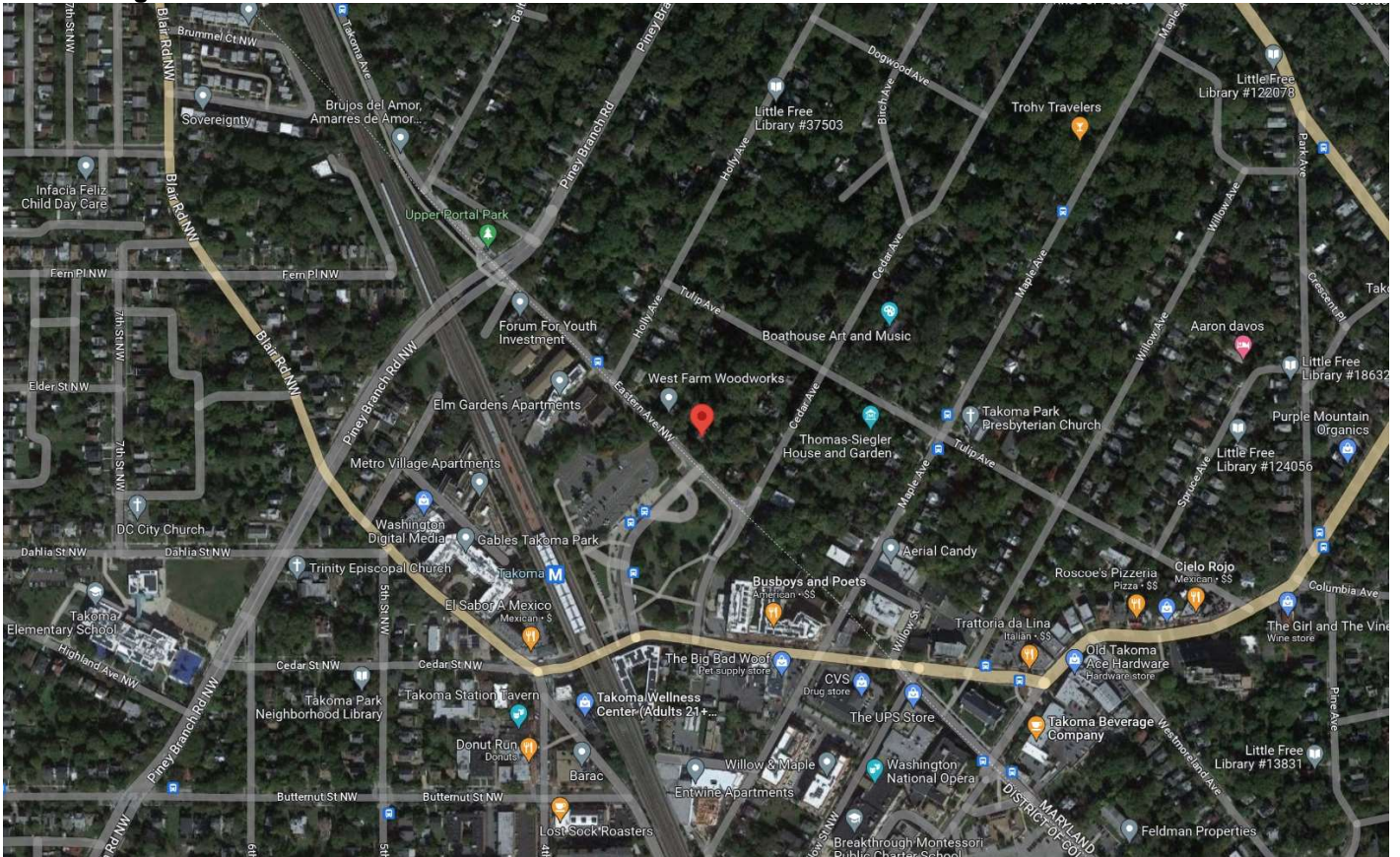
AOstructures Inc.
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www.AOstructures.com

Address: 7019 Eastern Ave. NW., Takoma Park, MD. 20912

Wind Design

Exposure: B
Wind Speed: 115 mph
Risk Category: II

Aerial Image





Wind Calculations

Per ASCE 7-16 § 29.4.4 - Components and Cladding - Solar Specific

Input Variables

Wind Speed	115 mph	Roof Slope	21 deg
Exposure Category	B	Mean Roof Height	30 ft
Roof Shape	Gable	Effective Wind Area	13.1 sft (standoff area)

Design Wind Pressure Calculations

Wind Pressure $P = qh (GC_p) (\gamma_e) (\gamma_a)$		(Eq. 29.4-7)
$qh = 0.00256 * K_z * K_{zt} * K_d * K_e * V^2$		(Eq. 26.10-1)
K_z (Exposure Coefficient) =	0.7	(Table 26.10-1)
K_{zt} (topographic factor) =	1	(Fig. 26.8-1)
K_d (Wind Directionality Factor) =	0.85	(Table 26.6-1)
K_e (Ground Elevation Factor) =	1	(Table 26.9-1)
V (Design Wind Speed) =	115 mph	(Fig. 26.5-1)
Risk Category =	II	(Table 1.5-1)
(γ_e) Array Edge Factor =	1.00	29.4.4
(γ_a) Solar Panel Pressure Equalization =	0.80	(Figure 29.4-8)
$qh (\gamma_e) (\gamma_a) =$	16.12	Ultimate Design Level
$0.6 * qh (\gamma_e) (\gamma_a) =$	9.67	ASD Design Level

Standoff Uplift Calculations (ASD Level)

Zone(s) =	3r	2n, 2r, 3e	1, 2e	(+)
$GC_p =$	-2.58	-2.38	-1.50	0.49 (Fig. 30.3-2C)
ASD Uplift Pressure (psf) =	-24.91	-22.98	-14.50	10.00
X Tributary Width (ft) =	2.67	4.00	4.00	
Y Tributary Width (ft) =	3.27	3.27	3.27	
Tributary Area (sf) =	8.72	13.08	13.08	
Footing Uplift (lb) =	-217.4	-300.7	-189.8	

Standoff Uplift Check

Maximum Design Uplift =	-301 lb
Standoff Uplift Capacity =	400 lb
400 lb capacity > 301 lb demand	Therefore, OK

Fastener Uplift Capacity Check

Fastener =	5/16"Ø Lag Screw
Number of Fasteners =	1
Embedment Depth =	2.0 in
Pullout Capacity Per Inch =	205 lb (per NDS)
Fastener Capacity =	410 lb
w/ Cd of 1.6 =	656 lb
656 lb capacity > 301 lb demand	Therefore, OK



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GRAVITY LOADS

Roof Snow Load Calculations

Unobstructed, Slippery Roof Surface?	no	
Roof Slope	21 degrees	
p_g = Ground Snow Load =	30.0 psf	
$p_f = 0.7 C_e C_t I p_g$		(ASCE7 - Eq 7-1)
C_e = Exposure Factor =	1.0	(ASCE7 - Table 7-2)
C_t = Thermal Factor =	1.0	(ASCE7 - Table 7-3)
I = Importance Factor =	1.0	(ASCE7 - 7.3.3)
p_f = Flat Roof Snow Load =	21.0 psf	
$p_s = C_s p_f$		(ASCE7 - Eq 7-2)
C_s = Slope Factor =	1.00	(ASCE7 - Fig. 7-2)
p_s = Sloped Roof Snow Load =	21.0 psf	

PV Dead Load = 3 psf (Per Lumina Solar)

Roof Dead Load (Roof's A & B)

Composition Shingle	4.00 psf
Roof Plywood	2.00
2x10 Rafters @ 24"o.c.	1.93
Vaulted Ceiling	4.00
Miscellaneous	1.07
Total Roof DL (Roof's A & B)	13.0 psf
DL Adjusted to 37 Degree Slope	16.3 psf

Roof Dead Load (Roof C)

Composition Shingle	4.00 psf
1x Decking	3.00
2"x4" Rafters @ 24"o.c.	1.12
Vaulted Ceiling	4.00 (Enclosed Attic)
Miscellaneous	1.88
Total Roof DL (Roof C)	14.0 psf
DL Adjusted to 21 Degree Slope	15.0 psf

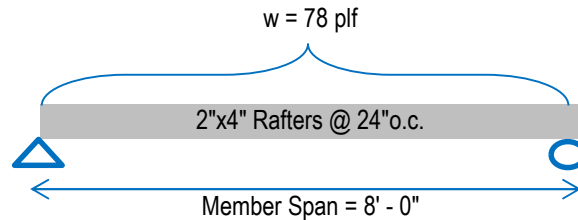


Framing Check

(Roof C)

PASS

Dead Load 15.0 psf
 PV Load 3.0 psf
 Snow Load 21.0 psf



Governing Load Combo = DL + SL
Total Load 39.0 psf

Member Properties

Member Size	S (in ³)	I (in ⁴)	Lumber Sp/Gr	Member Spacing
2"x4"	5.33	10.67	SPF#2	@ 24"o.c.

Check Bending Stress

Fb (psi) =	fb	x	Cd	x	Cf	x	Cr	(NDS Table 4.3.1)
	875	x	1.15	x	1.5	x	1.15	

Allowed Bending Stress = 1735.7 psi

Maximum Moment = $(wL^2) / 8$
 = 623.9365 ft#
 = 7487.238 in#

Actual Bending Stress = (Maximum Moment) / S
 = 1403.9 psi

Allowed > Actual - 80.9% Stressed -- Therefore, OK

Check Deflection

Allowed Deflection (Total Load) = $L/180$ (E = 1400000 psi Per NDS)

= 0.533 in

Deflection Criteria Based on = Simple Span

Actual Deflection (Total Load) = $(5*w*L^4) / (384*E*I)$

= 0.482 in

= L/200 > L/180 **Therefore OK**

Allowed Deflection (Live Load) = $L/240$

0.4 in

Actual Deflection (Live Load) = $(5*w*L^4) / (384*E*I)$

0.260 in

L/370 > L/240 **Therefore OK**

Check Shear

Member Area = 8.0 in² Fv (psi) = 135 psi (NDS Table 4A)

Allowed Shear = Fv * A = 1080 lb

Max Shear (V) = w * L / 2 = 312 lb

Allowed > Actual -- 28.9% Stressed -- Therefore, OK



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Appendix B: General Notes

GENERAL

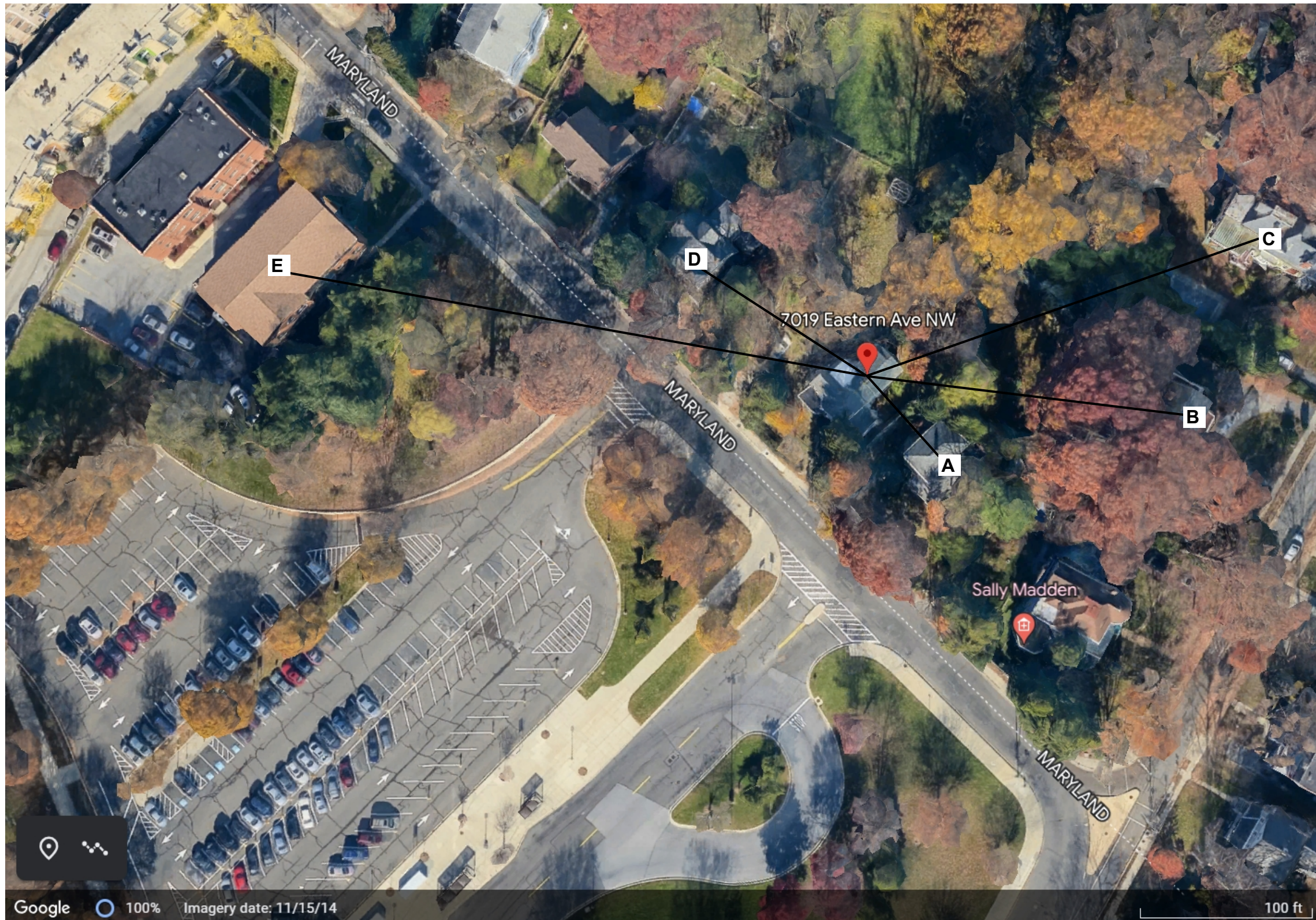
- The contractor shall verify all dimensions, property setbacks, AHJ/HOA CC&R's, elevations and site conditions before starting work and shall notify AOstructure, Inc. (AOstructures) of any discrepancies.
- All report conclusions represent AOstructures, Inc.'s best professional judgment based upon industry standards.
- Resolve any conflicts on the drawings with AOstructures, Inc before proceeding with construction.
- The design criteria used for this project & listed on the first page of the report is based on the engineers best judgement and/or provided by the ATC council. AHJ specific requests may differ. Please contact our team if the design criteria needs to be modified.
- A site visit was not physically conducted by AOstructures. The accompanying calculations and certification are provided with the understanding that the site building and construction standards meet an acceptable level of industry standards. It shall be the contractors responsibility to identify any irregularities such as inconsistent framing conditions, water damage, fire damage, cracked, split or noticeably deflecting framing members.
- AOstructures is not responsible for enforcing safety measures or regulations. The contractor shall design, construct, and maintain all safety devices including shoring and bracing, and shall be solely responsible for conforming to all local, state and federal safety and health standards, laws and regulations. The contractor shall take necessary precautions to maintain and insure the integrity of the structure during construction. If a lawsuit is filed by one of the contractor's or subcontractor's employees, or any one else, the contractor will indemnify, defend and hold the owner and aostructures, inc harmless of any and all such claims.
- Any and all waterproofing shall be provided by the contractor. AOstructures is not responsible for waterproofing.
- All hardware shall be installed per manufacturer specifications and within specified design limitations. AOstructures, Inc. assumes no responsibility for incorrectly installed hardware or hardware installed outside of the manufacturer specifications.

USER RELIANCE

- AOstructures was engaged by Lumina Solar (Client) to perform this assessment. This report and the information therein, are for the exclusive use of the Client. This report has no other purpose and shall not be relied upon, or used, by any other person or entity without the written consent of AOstructures. Third parties that obtain this report, or the information within shall have no rights of recourse or recovery against AOstructures, it's officers or employees.

ROOF MOUNTED ARRAY'S

- If an analysis of a supporting structure is included in our scope of work, the structural assessment only applies to the section of the roof that is directly supporting the proposed solar PV system.
- No structural members can be cut for conduit, etc., unless specifically shown. Obtain prior written approval for installation of any additional conduit, etc.
- It is assumed that a standard quality of construction care was used to construct the original building. It shall be the contractors responsibility to field verify any and all framing member supporting the proposed PV array are in adequate condition. The contractor shall field inspect for sub-standard construction means, signs of dryrot, mold, fire damage, etc. and notify engineer if any compromised material is found on site prior to starting construction.
- It is assumed that there have been no additional loads (HVAC or MEP equipment, additional layers of roofing, etc) added to the building over the course of the structures history. The contractor and/or client shall verify this with the property owner and notify AOstructures, Inc. if additional load has been added to the structure already.
- Flexible utility connections must be used at any building seismic joint.
- Care should be taken to ensure that PV arrays do not preclude drainage of rain water.
- Unless otherwise noted, construction material shall be evenly distributed if placed on framed floors or roofs. Loads shall not exceed the allowable loading for the supporting members and their connections.
- All lags or wood screws at the roof shall be stainless steel and installed withing the middle 1/3 of the dimensional width of the framing members.
- All fasteners shall be a minimum of 6" away from any truss panel or hinge joints, truss plates and/or member ends. Field verify location of fasteners prior to starting construction. All fasteners shall be pre-drilled to avoid splitting existing lumber.
- Unless otherwise noted, all lags installed in underlying roof framing members shall be embedded (threaded embed) a minimum of 2.5" into the underlying framing.
- AOstructures is not responsible for downslope effects of snow shedding or sliding off of the PV array nor any damage to downslope decks, roofs, walkways, landscaping, automobiles, pets, people, etc.. If snow guards are requested by the customer, notify AOstructures.



FOR PERMITTING USE ONLY

PROJECT ADDRESS:

SABRINA EATON
 7019 EASTERN AVENUE
 NORTHWEST TAKOMA PARK,
 MD 20912

CONTRACTOR INFO:



3600 COMMERCE DR
 SUITE 601
 BALTIMORE, MD
 21227
 (443) 955-0779

LICENSE NUMBER:

MHIC-30991

REV	DATE
IFC	09/27/2023

**GLARE STUDY -
 MAP**

G001

FOR PERMITTING USE ONLY

SOUTH-FACING ARRAY ANALYSIS

INSTALLATION AZIMUTH: 136 DEG.
 INSTALLATION SLOPE: 33 DEG.
 INSTALLATION HEIGHT: 25 FEET ABOVE GRADE
 GRADE ELEVATION: 276 FEET

(3)

LOCATION	AZIMUTH (DEG)	(1) SUN AZIMUTH REQ'D FOR REFLECTION	DISTANCE AWAY (FT)	ELEVATION (FT)	(2) ELEVATION ANGLE (DEG)	SUN ANGLE ABOVE HORIZ. REQ'D FOR REFLECTION
INSTALLATION	136	----	----	301	----	----
BUILDING A	137	225	57	274	25.35	139.35
BUILDING B	97	185	176	351	15.86	129.86
BUILDING C	71	159	245	308	1.64	115.64
BUILDING D	308	36	124	287	6.44	120.44
BUILDING E	282	10	340	300	0.17	114.17

NOTE: Elevations & distances taken from Google Earth

(1) = INSTALLATION AZIMUTH + (INSTALLATION AZIMUTH - BUILDING OF CONCERN AZIMUTH)

(2) = VERTICAL ANGLE BETWEEN INSTALLATION AND BUILDING OF CONCERN DUE TO ELEVATION DIFFERENCE

(3) = (90 - INSTALLATION SLOPE)x2 + ELEVATION ANGLE

LOCATION	SUN AZIMUTH (DEG)	MIN. SUN ELEVATION (DEG)	MAX. SUN ELEVATION (DEG)	SUN ANGLE REQ'D FOR REFLECTION	REFLECTION?
BUILDING A	225	12	68	139.35	NO
BUILDING B	185	27	73	129.86	NO
BUILDING C	159	23	72	115.64	NO
BUILDING D	36	N/A	N/A	120.44	NO
BUILDING E	10	N/A	N/A	114.17	NO

NORTH-FACING ARRAY ANALYSIS

INSTALLATION AZIMUTH: 316 DEG.
 INSTALLATION SLOPE: 21 DEG.
 INSTALLATION HEIGHT: 25 FEET ABOVE GRADE
 GRADE ELEVATION: 276 FEET

(3)

LOCATION	AZIMUTH (DEG)	(1) SUN AZIMUTH REQ'D FOR REFLECTION	DISTANCE AWAY (FT)	ELEVATION (FT)	(2) ELEVATION ANGLE (DEG)	SUN ANGLE ABOVE HORIZ. REQ'D FOR REFLECTION
INSTALLATION	316	----	----	301	----	----
BUILDING A	137	135	57	274	25.35	163.35
BUILDING B	97	175	176	351	15.86	153.86
BUILDING C	71	201	245	308	1.64	139.64
BUILDING D	308	324	124	287	6.44	144.44
BUILDING E	282	10	340	300	0.17	138.17

NOTE: Elevations & distances taken from Google Earth

(1) = INSTALLATION AZIMUTH + (INSTALLATION AZIMUTH - BUILDING OF CONCERN AZIMUTH)

(2) = VERTICAL ANGLE BETWEEN INSTALLATION AND BUILDING OF CONCERN DUE TO ELEVATION DIFFERENCE

(3) = (90 - INSTALLATION SLOPE)x2 + ELEVATION ANGLE

LOCATION	SUN AZIMUTH (DEG)	MIN. SUN ELEVATION (DEG)	MAX. SUN ELEVATION (DEG)	SUN ANGLE REQ'D FOR REFLECTION	REFLECTION?
BUILDING A	135	12	68	163.35	NO
BUILDING B	175	26	72	153.86	NO
BUILDING C	201	23	72	139.64	NO
BUILDING D	324	N/A	N/A	144.44	NO
BUILDING E	10	N/A	N/A	138.17	NO

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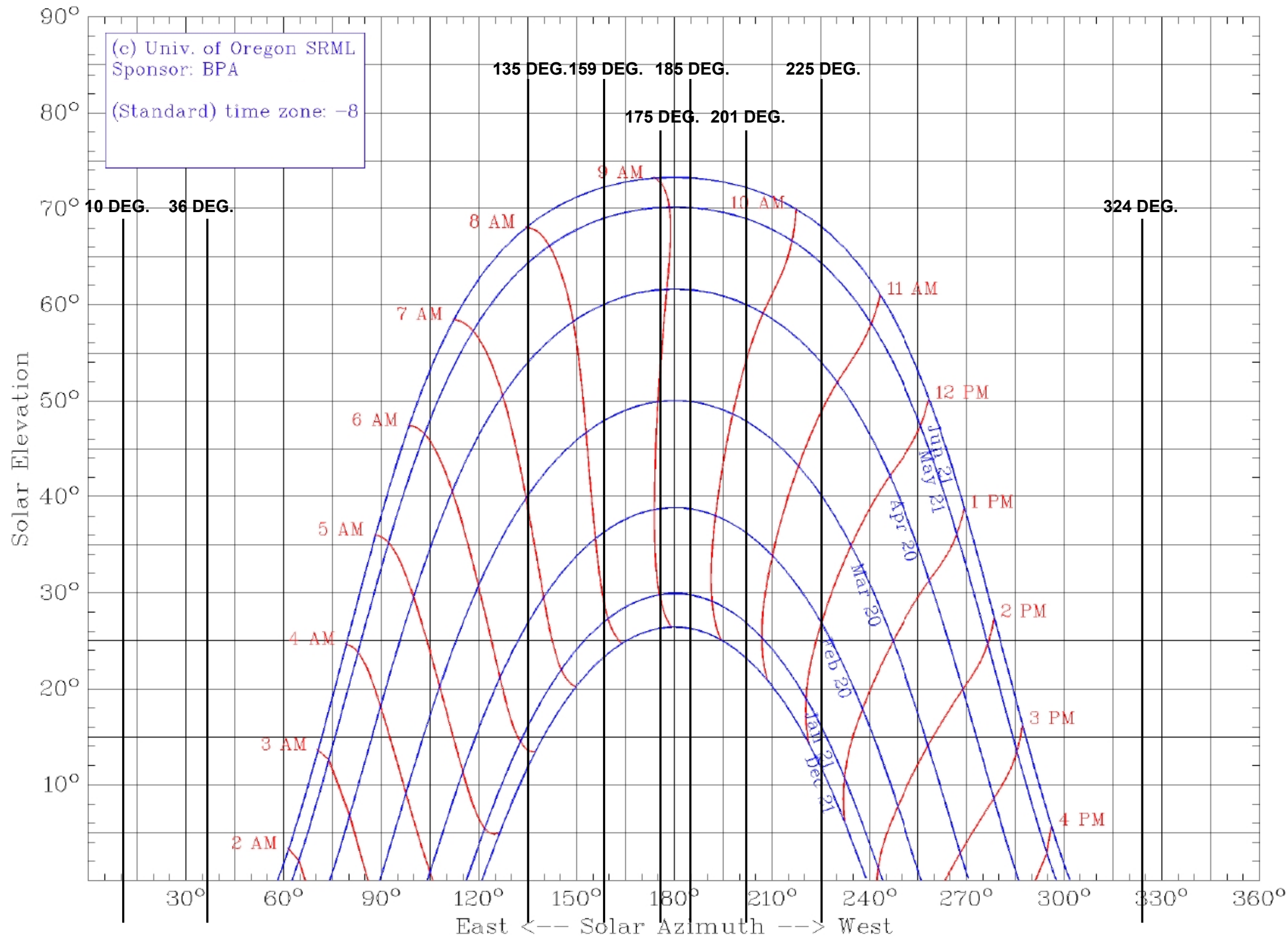
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GLARE STUDY -
RESULTS

G002



FOR PERMITTING USE ONLY

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REV	DATE
IFC	09/27/2023

GLARE STUDY -
 SUN CHART

G003