



HISTORIC PRESERVATION COMMISSION

Marc Elrich
County Executive

Robert K. Sutton
Chairman

Date: January 23, 2022

MEMORANDUM

TO: Ehsan Motazedi, Acting DPS Director & Deputy Director Department of
Permitting Services
FROM: Winnie Cargill
Historic Preservation Section
Maryland-National Capital Park & Planning Commission Historic Area Work
SUBJECT: Permit #1018149 - Solar Panel Installation

The Montgomery County Historic Preservation Commission (HPC) has reviewed the attached application for a Historic Area Work Permit (HAWP). This application was **Approved** by the HPC Staff.

The HPC staff has reviewed and stamped the attached construction drawings.

THE BUILDING PERMIT FOR THIS PROJECT SHALL BE ISSUED CONDITIONAL UPON ADHERENCE TO THE ABOVE APPROVED HAWP CONDITIONS AND MAY REQUIRE APPROVAL BY DPS OR ANOTHER LOCAL OFFICE BEFORE WORK CAN BEGIN.

Applicant: Beth Vallandingham
Address: 106 Water Street, Brookeville

This HAWP approval is subject to the general condition that the applicant will obtain all other applicable Montgomery County or local government agency permits. After the issuance of these permits, the applicant must contact this Historic Preservation Office if any changes to the approved plan are made. Once work is complete the applicant will contact Winnie Cargill at 301.495.2108 or winnie.cargill@montgomeryplanning.org to schedule a follow-up site visit.





HISTORIC PRESERVATION COMMISSION

HAWP #: 1018149 at: 106 Water Street, Brookeville

submitted on: 1/11/2023

has been reviewed and determined that the proposal fits into the following category/categories:

- Repair or replacement of a masonry foundation with new masonry materials that closely match the original in appearance;
Installation of vents or venting pipes in locations not visible from the public right-of-way;
New gutters and downspouts;
Removal of vinyl, aluminum, asbestos, or other artificial siding when the original siding is to be repaired and/or replaced in kind;
Removal of accessory buildings that are not original to the site or non-historic construction;
Repair or replacement of missing or deteriorated architectural details such as trim or other millwork, stairs or stoops, porch decking or ceilings, columns, railings, balusters, brackets shutters, etc., with new materials that match the old in design, texture, visual characteristics, and, where possible materials, so long as the applicant is able to provide one extant example, photographic evidence, or physical evidence that serves as the basis for the work proposed;
Construction of wooden decks that are at the rear of a structure and are not visible from a public right-of-way;
Roof replacement with -compatible roofing materials, or with architectural shingles replacing 3-Tab asphalt shingles;
Installation of storm windows or doors that are compatible with the historic resource or district;
Repair, replacement or installation of foundation-level doors, windows, window wells, and areaways, or foundation vents, venting pipes, or exterior grills that do not alter the character-defining features and/or the historic character of the resource;
Construction of fences that are compatible with the historic site or district in material, height, location, and design;
Fence is lower than 48" in front of rear wall plane;

- Construction of walkways, parking pads, patios, driveways, or other paved areas that are not visible from a public right-of-way and measure no more than 150 square feet in size;
Replacement of existing walkways, parking pads, patios, driveways, or other paved areas with materials that are compatible with the visual character of the historic site and district and that are no greater than the dimensions of the existing hardscape;
Construction of small accessory buildings no larger than 250 square feet in size that are not visible from the public right-of-way;
Installations of skylights on the rear of a structure that will not be visible from the public right-of-way, and would not remove or alter character-defining roof materials;
[checked] Installation of solar panels and arrays in locations that are not readily visible from the public right-of-way or that are designed so as to have a minimal impact on the historic resource or the historic district (e.g., systems that are ground-mounted in areas other than the front or side yard of a corner lot, located on accessory or outbuildings, on non-historic additions, or on rear facing roof planes);
Installation of car charging stations in any location on a property or in the right-of-way;
Installation of satellite dishes;
Removal of trees greater than 6" in diameter (d.b.h.) that are dead, dying, or present an immediate hazard.
Removal of trees greater than 6" in diameter (d.b.h.) in the rear of the property that will not impact the overall tree canopy of the surrounding district or historic site;
Replacement tree required as a condition; and,
Other minor alterations that may be required by the Department of Permitting Services post-Commission approval that would have no material effect on the historic character of the property.

Staff finds the proposal complies with Chapter 24A, the Secretary of the Interior's Standards for Rehabilitation, and any additional requisite guidance. Under the authority of COMCOR No. 24A.04.01, this HAWP is approved by Christina Cargill on 1/23/2023. The approval memo and stamped drawings follow.



APPLICATION FOR HISTORIC AREA WORK PERMIT
HISTORIC PRESERVATION COMMISSION
301.563.3400

FOR STAFF ONLY:
HAWP# 1018149
DATE ASSIGNED

APPLICANT:

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

AGENT/CONTACT (if applicable):

Name: E-mail:
Address: City: Zip:
Daytime Phone: 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:

- Checkboxes for: 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.

Beth Vallandingham

Signature of owner or authorized agent

Date

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

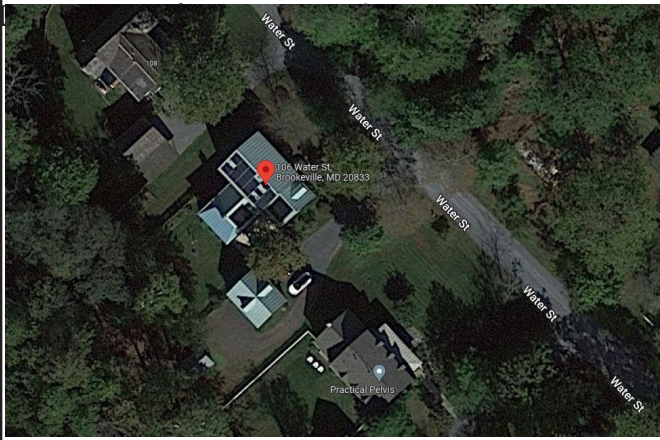
Description of Work Proposed: Please give an overview of the work to be undertaken:



REVIEWED

By Winnie Cargill at 2:08 pm, Jan 23, 2023

Work Item 1: _____



Work Item 2: _____



Work Item 3: _____



December 9, 2022

Certification Letter

Project/Job # 20812139

Project Address: Johnson Residence
 106 Water St
 Brookeville, MD 20833

AHJ Brookeville Town
 SC Office Beltsville

Design Criteria:

- Total Number of Modules = 14
- Applicable Codes = Structure: 2018 IEBC; PV: 2018 IBC, ASCE 7-16, and 2018 NDS
- Risk Category = II
- Wind Speed = 115 mph (3-s Gust - Vult), Exposure Category C, Partially/Fully Enclosed Method
- Ground Snow Load = 30 psf
- MP1: 2x4 Pre-Fab Truss @ 24" OC, Standing Seam Roof, Roof DL = 5.5 psf, Roof LL/SL = 16 psf (Non-PV), Roof LL/SL = 12.5 psf (PV)
- MP4: Assumed 2x4 Pre-Fab Truss @ 24" OC, Standing Seam Roof, Roof DL = 5.5 psf, Roof LL/SL = 20 psf (Non-PV), Roof LL/SL = 19.5 psf (PV)
- MP5: 2x4 Pre-Fab Truss @ 24" OC, Standing Seam Roof, Roof DL = 5.5 psf, Roof LL/SL = 12 psf (Non-PV), Roof LL/SL = 8.7 psf (PV)

Note: Per IBC 1613.1; Seismic check is not required because $S_s = 0.136 < 0.4g$ and Seismic Design Category (SDC) = B < D

To Whom It May Concern,

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 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.

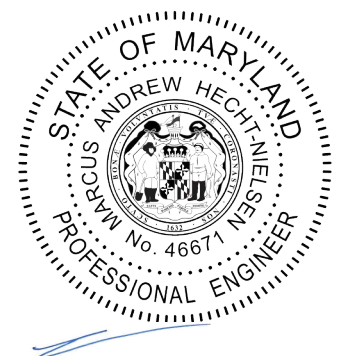
I evaluated the existing roof structure of the building at the above address and analyzed its capacity to support the additional loads imposed by the PV system. I certify that no structural modifications of the existing roof structure are required. The existing roof structure meets the standards and 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.

01/06/2023

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. 46671, Expiration Date: 05/18/2023



HARDWARE DESIGN AND STRUCTURAL ANALYSIS RESULTS SUMMARY TABLES

Landscape Hardware	Hardware - Landscape Modules' Standoff Specifications					
	X-X Spacing	X-X Cantilever	Y-Y Spacing	Y-Y Cantilever	Configuration	Uplift DCR
MP1	21"	11"	41"	NA	Staggered	64.9%
MP4	21"	13"	41"	NA	Staggered	54.9%
MP5	21"	11"	41"	NA	Staggered	65.9%

Portrait Hardware	Hardware - Portrait Modules' Standoff Specifications					
	X-X Spacing	X-X Cantilever	Y-Y Spacing	Y-Y Cantilever	Configuration	Uplift DCR
MP1					NA	NA
MP4					NA	NA
MP5					NA	NA

Mounting Plane	Structure Information			Qualification Results
	Type	Pitch	Spacing	Member Evaluation Results
MP1	Pre-Fab Truss	34°	24" O.C.	Member Impact Check OK
MP4	Pre-Fab Truss	14°	24" O.C.	Member Analysis OK
MP5	Pre-Fab Truss	45°	24" O.C.	Member Impact Check OK

STRUCTURE ANALYSIS - LOADING SUMMARY AND MEMBER CHECK - MP1

Member Properties Summary					
MP1		Horizontal Member Spans		Rafter Properties	
		Overhang	1.20 ft	Actual W	1.50"
Roof System Properties		Span 1	4.55 ft	Actual D	3.50"
Number of Spans (w/o Overhang)	2	Span 2	5.83 ft	Nominal	Yes
Roofing Material	Standing Seam Roof	Span 3		A (in²)	5.25
Re-Roof	No	Span 4		Sx (in.³)	3.06
Plywood Sheathing	Yes	Span 5		Ix (in⁴)	5.36
Board Sheathing	None	Total Rake Span	13.97 ft	TL Defl'n Limit	120
Vaulted Ceiling	No	PV 1 Start	2.75 ft	Wood Species	SPF
Ceiling Finish	1/2" Gypsum Board	PV 1 End	8.58 ft	Wood Grade	#2
Rafter Slope	34°	PV 2 Start		Fb (psi)	875
Rafter Spacing	24" O.C.	PV 2 End		Fv (psi)	135
Top Lat Bracing	Full	PV 3 Start		E (psi)	1,400,000
Bot Lat Bracing	At Supports	PV 3 End		E-min (psi)	510,000

Member Loading Summary					
Roof Pitch	8/12	Initial	Pitch Adjust	Non-PV Areas	PV Areas
Roof Dead Load	DL	5.5 psf	x 1.21	6.6 psf	6.6 psf
PV Dead Load	PV-DL	3.0 psf	x 1.21		3.6 psf
Roof Live Load	RLL	20.0 psf	x 0.80	16.0 psf	
Snow Load	SL^{1,2}	30.0 psf	x 0.42 x 0.42	12.5 psf	12.5 psf
Total Load (Governing LC)	TL			22.6 psf	22.8 psf

Notes: 1. ps = Cs*pf; Cs -roof, Cs -pv per ASCE 7 [Figure 7.4-1]; 2. pf = 0.7 (Ce) (Ct) (Is) pg ; Ce=0.9, Ct=1.1, Is=1.0;

Member Analysis Results Summary					
Governing Analysis	Pre-PV	Load (psf)	Post-PV	Net Impact	Result
Gravity Loading Check	22.6		22.8	1%	Pass

ZEP HARDWARE DESIGN CALCULATIONS - MP1

Mounting Plane Information			
Roofing Material		Standing Seam Roof	
Roof Slope		34°	
Framing Type / Direction		Y-Y Rafters	
PV System Type		SolarCity SleekMount™	
Zep System Type		ZS Seam	
Standoff (Attachment Hardware)		S-5 Clamp	
Standing Seam/Trap Spacing		21	
Module Assembly has Interlocks?		Yes	

Wind Design Criteria			
Design Standard		ASCE 7-16	
Wind Design Method		Partially/Fully Enclosed Method	
Ultimate Wind Speed	V-Ult	115 mph	Fig. 26.5-1B
Exposure Category		C	Section 26.7
Roof Style		Gable Roof	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Mean Roof Height	h	25 ft	Section 26.2

Notes: 1. Risk Category = II

Wind Pressure Calculation Coefficients			
Wind Pressure Exposure	K_z	0.95	Table 26.10-1
Topographic Factor	K_{zt}	1.00	Section 26.8
Wind Directionality Factor	K_d	0.85	Section 26.6-1
Ground Elevation Factor	K_e	1.00	Table 26.9-1
Velocity Pressure	q_h	$q_h = 0.00256 (K_z) (K_{zt}) (K_d) (K_e) (V^2)$ 27.2 psf	Equation 26.10-1

Wind Pressure			
Ext. Pressure Coefficient (Up)	$G_{Cp} (Up)$	-1.47	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Ext. Pressure Coefficient (Down)	$G_{Cp} (Down)$	0.77	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Design Wind Pressure	p	$p = q_h (y_E) (y_a) (G_{Cp})$; $y_E = 1.15$, $y_A = 0.60$	Equation 29.4-7
Wind Pressure Up (Design Ult)	$p_{(up)}$	-16.6 -27.7 psf	
Wind Pressure Down (Design Ult)	$p_{(down)}$	9.6 16 psf	

Notes: 1. Wind Zone Perimeter Width (a) = 6.6 ft.; Effective Wind Area (A) = 21.3 sf

2. y_E = Array Edge Factor and y_A = Solar Panel Pressure Equalization Factor per SEAoC PV2-2017

ALLOWABLE STANDOFF SPACINGS

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Landscape	21"	41"
Max Allowable Cantilever	Landscape	11"	NA
Standoff Configuration	Landscape	Staggered	
Max Standoff Tributary Area (Interior)	Trib	6 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-91 lbs	
Uplift Capacity of Standoff	T-allow	140 lbs	
Standoff Demand/Capacity (Interior)	DCR	64.9%	

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Portrait	"	"
Max Allowable Cantilever	Portrait	"	"
Standoff Configuration	Portrait	NA	
Max Standoff Tributary Area (Interior)	Trib	NA	
PV Assembly Dead Load	W-PV	NA	
Net Wind Uplift at Standoff (Interior)	T-actual	NA	
Uplift Capacity of Standoff	T-allow	NA	
Standoff Demand/Capacity (Interior)	DCR	NA	

STRUCTURE ANALYSIS - LOADING SUMMARY AND MEMBER CHECK - MP4

Member Properties Summary					
MP4		Horizontal Member Spans		Rafter Properties	
		Overhang	1.20 ft	Actual W	1.50"
Roof System Properties		Span 1	3.83 ft	Actual D	3.50"
Number of Spans (w/o Overhang)	3	Span 2	3.44 ft	Nominal	Yes
Roofing Material	Standing Seam Roof	Span 3	3.41 ft	A (in ²)	5.25
Re-Roof	No	Span 4		Sx (in. ³)	3.06
Plywood Sheathing	Yes	Span 5		Ix (in ⁴)	5.36
Board Sheathing	None	Total Rake Span	12.23 ft	TL Defl'n Limit	120
Vaulted Ceiling	No	PV 1 Start	1.33 ft	Wood Species	SPF
Ceiling Finish	1/2" Gypsum Board	PV 1 End	8.08 ft	Wood Grade	#2
Rafter Slope	14°	PV 2 Start		Fb (psi)	875
Rafter Spacing	24" O.C.	PV 2 End		Fv (psi)	135
Top Lat Bracing	Full	PV 3 Start		E (psi)	1,400,000
Bot Lat Bracing	At Supports	PV 3 End		E-min (psi)	510,000

Member Loading Summary					
Roof Pitch	3/12	Initial	Pitch Adjust	Non-PV Areas	PV Areas
Roof Dead Load	DL	5.5 psf	x 1.03	5.7 psf	5.7 psf
PV Dead Load	PV-DL	3.0 psf	x 1.03		3.1 psf
Roof Live Load	RLL	20.0 psf	x 1.00	20.0 psf	
Snow Load	SL ^{1,2}	30.0 psf	x 0.65 x 0.65	19.5 psf	19.5 psf
Total Load (Governing LC)	TL			25.7 psf	28.3 psf

Notes: 1. ps = Cs*pf; Cs -roof, Cs -pv per ASCE 7 [Figure 7.4-1]; 2. pf = 0.7 (Ce) (Ct) (Is) pg ; Ce=0.9, Ct=1.1, Is=1.0;

Member Analysis Results Summary					
Governing Analysis	Max Moment	@ Location	Capacity	DCR	Result
Shear Stress (psi)	27.5	1.2 ft	155.3	18%	Pass

ZEP HARDWARE DESIGN CALCULATIONS - MP4

Mounting Plane Information			
Roofing Material		Standing Seam Roof	
Roof Slope		14°	
Framing Type / Direction		Y-Y Rafters	
PV System Type		SolarCity SleekMount™	
Zep System Type		ZS Seam	
Standoff (Attachment Hardware)		S-5 Clamp	
Standing Seam/Trap Spacing		21	
Module Assembly has Interlocks?		Yes	

Wind Design Criteria			
Design Standard		ASCE 7-16	
Wind Design Method		Partially/Fully Enclosed Method	
Ultimate Wind Speed	V-Ult	115 mph	Fig. 26.5-1B
Exposure Category		C	Section 26.7
Roof Style		Hip Roof	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Mean Roof Height	h	25 ft	Section 26.2

Notes: 1. Risk Category = II

Wind Pressure Calculation Coefficients			
Wind Pressure Exposure	K_z	0.95	Table 26.10-1
Topographic Factor	K_{zt}	1.00	Section 26.8
Wind Directionality Factor	K_d	0.85	Section 26.6-1
Ground Elevation Factor	K_e	1.00	Table 26.9-1
Velocity Pressure	q_h	$q_h = 0.00256 (K_z) (K_{zt}) (K_d) (K_e) (V^2)$ 27.2 psf	Equation 26.10-1

Wind Pressure			
Ext. Pressure Coefficient (Up)	$G_{Cp} (Up)$	-1.29	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Ext. Pressure Coefficient (Down)	$G_{Cp} (Down)$	0.57	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Design Wind Pressure	p	$p = q_h (y_E) (y_a) (G_{Cp})$; $y_E = 1.15$, $y_a = 0.60$	Equation 29.4-7
Wind Pressure Up (Design Ult)	$p_{(up)}$	-14.6 -24.3 psf	
Wind Pressure Down (Design Ult)	$p_{(down)}$	9.6 16 psf	

Notes: 1. Wind Zone Perimeter Width (a) = 6.6 ft.; Effective Wind Area (A) = 21.3 sf

2. y_E = Array Edge Factor and y_a = Solar Panel Pressure Equalization Factor per SEAoC PV2-2017

ALLOWABLE STANDOFF SPACINGS

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Landscape	21"	41"
Max Allowable Cantilever	Landscape	13"	NA
Standoff Configuration	Landscape	Staggered	
Max Standoff Tributary Area (Interior)	Trib	6 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-77 lbs	
Uplift Capacity of Standoff	T-allow	140 lbs	
Standoff Demand/Capacity (Interior)	DCR	54.9%	

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Portrait	"	"
Max Allowable Cantilever	Portrait	"	"
Standoff Configuration	Portrait	NA	
Max Standoff Tributary Area (Interior)	Trib	NA	
PV Assembly Dead Load	W-PV	NA	
Net Wind Uplift at Standoff (Interior)	T-actual	NA	
Uplift Capacity of Standoff	T-allow	NA	
Standoff Demand/Capacity (Interior)	DCR	NA	

STRUCTURE ANALYSIS - LOADING SUMMARY AND MEMBER CHECK - MP5

Member Properties Summary					
MP5		Horizontal Member Spans		Rafter Properties	
		Overhang	1.20 ft	Actual W	1.50"
Roof System Properties		Span 1	4.74 ft	Actual D	3.50"
Number of Spans (w/o Overhang)	2	Span 2	5.69 ft	Nominal	Yes
Roofing Material	Standing Seam Roof	Span 3		A (in²)	5.25
Re-Roof	No	Span 4		Sx (in.³)	3.06
Plywood Sheathing	Yes	Span 5		Ix (in⁴)	5.36
Board Sheathing	None	Total Rake Span	16.44 ft	TL Defl'n Limit	120
Vaulted Ceiling	No	PV 1 Start	2.67 ft	Wood Species	SPF
Ceiling Finish	1/2" Gypsum Board	PV 1 End	10.08 ft	Wood Grade	#2
Rafter Slope	45°	PV 2 Start		Fb (psi)	875
Rafter Spacing	24" O.C.	PV 2 End		Fv (psi)	135
Top Lat Bracing	Full	PV 3 Start		E (psi)	1,400,000
Bot Lat Bracing	At Supports	PV 3 End		E-min (psi)	510,000

Member Loading Summary					
Roof Pitch	12/12	Initial	Pitch Adjust	Non-PV Areas	PV Areas
Roof Dead Load	DL	5.5 psf	x 1.41	7.8 psf	7.8 psf
PV Dead Load	PV-DL	3.0 psf	x 1.41		4.2 psf
Roof Live Load	RLL	20.0 psf	x 0.60	12.0 psf	
Snow Load	SL^{1,2}	30.0 psf	x 0.29 x 0.29	8.7 psf	8.7 psf
Total Load (Governing LC)	TL			19.8 psf	20.7 psf

Notes: 1. ps = Cs*pf; Cs -roof, Cs -pv per ASCE 7 [Figure 7.4-1]; 2. pf = 0.7 (Ce) (Ct) (Is) pg ; Ce=0.9, Ct=1.1, Is=1.0;

Member Analysis Results Summary					
Governing Analysis	Pre-PV	Load (psf)	Post-PV	Net Impact	Result
Gravity Loading Check	19.8		20.7	5%	Pass

ZEP HARDWARE DESIGN CALCULATIONS - MP5

Mounting Plane Information			
Roofing Material		Standing Seam Roof	
Roof Slope		45°	
Framing Type / Direction		Y-Y Rafters	
PV System Type		SolarCity SleekMount™	
Zep System Type		ZS Seam	
Standoff (Attachment Hardware)		S-5 Clamp	
Standing Seam/Trap Spacing		21	
Module Assembly has Interlocks?		Yes	

Wind Design Criteria			
Design Standard		ASCE 7-16	
Wind Design Method		Partially/Fully Enclosed Method	
Ultimate Wind Speed	V-Ult	115 mph	Fig. 26.5-1B
Exposure Category		C	Section 26.7
Roof Style		Gable Roof	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Mean Roof Height	h	25 ft	Section 26.2

Notes: 1. Risk Category = II

Wind Pressure Calculation Coefficients			
Wind Pressure Exposure	K_z	0.95	Table 26.10-1
Topographic Factor	K_{zt}	1.00	Section 26.8
Wind Directionality Factor	K_d	0.85	Section 26.6-1
Ground Elevation Factor	K_e	1.00	Table 26.9-1
Velocity Pressure	q_h	$q_h = 0.00256 (K_z) (K_{zt}) (K_d) (K_e) (V^2)$ 27.2 psf	Equation 26.10-1

Wind Pressure			
Ext. Pressure Coefficient (Up)	$G_{Cp} (Up)$	-1.47	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Ext. Pressure Coefficient (Down)	$G_{Cp} (Down)$	0.77	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Design Wind Pressure	p	$p = q_h (y_E) (y_a) (G_{Cp})$; $y_E = 1.15$, $y_a = 0.60$	Equation 29.4-7
Wind Pressure Up (Design Ult)	$p_{(up)}$	-16.6 -27.7 psf	
Wind Pressure Down (Design Ult)	$p_{(down)}$	9.6 16 psf	

Notes: 1. Wind Zone Perimeter Width (a) = 6.6 ft.; Effective Wind Area (A) = 21.3 sf

2. y_E = Array Edge Factor and y_a = Solar Panel Pressure Equalization Factor per SEAoC PV2-2017

ALLOWABLE STANDOFF SPACINGS

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Landscape	21"	41"
Max Allowable Cantilever	Landscape	11"	NA
Standoff Configuration	Landscape	Staggered	
Max Standoff Tributary Area (Interior)	Trib	6 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-92 lbs	
Uplift Capacity of Standoff	T-allow	140 lbs	
Standoff Demand/Capacity (Interior)	DCR	65.9%	

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Portrait	"	"
Max Allowable Cantilever	Portrait	"	"
Standoff Configuration	Portrait	NA	
Max Standoff Tributary Area (Interior)	Trib	NA	
PV Assembly Dead Load	W-PV	NA	
Net Wind Uplift at Standoff (Interior)	T-actual	NA	
Uplift Capacity of Standoff	T-allow	NA	
Standoff Demand/Capacity (Interior)	DCR	NA	

ABBREVIATIONS

A AMPERE AC ALTERNATING CURRENT BLDG BUILDING CONC CONCRETE DC DIRECT CURRENT EGC EQUIPMENT GROUNDING CONDUCTOR (E) EXISTING EMT ELECTRICAL METALLIC TUBING FSB FIRE SET-BACK GALV GALVANIZED GEC GROUNDING ELECTRODE CONDUCTOR GND GROUND HDG HOT DIPPED GALVANIZED I CURRENT Imp CURRENT AT MAX POWER Isc SHORT CIRCUIT CURRENT kVA KILOVOLT AMPERE kW KILOWATT LBW LOAD BEARING WALL MIN MINIMUM (N) NEW NEUT NEUTRAL NTS NOT TO SCALE OC ON CENTER PL PROPERTY LINE POI POINT OF INTERCONNECTION PV PHOTOVOLTAIC SCH SCHEDULE S STAINLESS STEEL STC STANDARD TESTING CONDITIONS TYP TYPICAL UPS UNINTERRUPTIBLE POWER SUPPLY V VOLT Vmp VOLTAGE AT MAX POWER Voc VOLTAGE AT OPEN CIRCUIT W WATT 3R NEMA 3R, RAIN TIGHT

ELECTRICAL NOTES

1. THIS SYSTEM IS GRID-INTERTIED VIA A UL-LISTED POWER-CONDITIONING INVERTER.
2. A NATIONALLY - RECOGNIZED TESTING LABORATORY SHALL LIST ALL EQUIPMENT IN COMPLIANCE WITH ART. 110.3.
3. WHERE ALL TERMINALS OF THE DISCONNECTING MEANS MAY BE ENERGIZED IN THE OPEN POSITION, A SIGN WILL BE PROVIDED WARNING OF THE HAZARDS PER ART. 690.17.
4. EACH UNGROUNDED CONDUCTOR OF THE MULTIWIRED BRANCH CIRCUIT WILL BE IDENTIFIED BY PHASE AND SYSTEM PER ART. 210.5.
5. CIRCUITS OVER 250V TO GROUND SHALL COMPLY WITH ART. 250.97, 250.92(B).
6. DC CONDUCTORS EITHER DO NOT ENTER BUILDING OR ARE RUN IN METALLIC RACEWAYS OR ENCLOSURES TO THE FIRST ACCESSIBLE DC DISCONNECTING MEANS PER ART. 690.31(E).
7. ALL WIRES SHALL BE PROVIDED WITH STRAIN RELIEF AT ALL ENTRY INTO BOXES AS REQUIRED BY UL LISTING.
8. MODULE FRAMES SHALL BE GROUNDED AT THE UL - LISTED LOCATION PROVIDED BY THE MANUFACTURER USING UL LISTED GROUNDING HARDWARE.
9. MODULE FRAMES, RAIL, AND POSTS SHALL BE BONDED WITH EQUIPMENT GROUND CONDUCTORS.

JURISDICTION NOTES

STRUCTURAL DESIGN FOR THE SUPPORTING STRUCTURE OF THE HOUSE WAS PERFORMED IN ACCORDANCE WITH IRC/IBC 2018 - STRUCTURAL DESIGN FOR THE RACK SYSTEM AND MOUNTING HARDWARE WAS PERFORMED IN ACCORDANCE WITH IRC/IBC 2018.



REVIEWED
By Winnie Cargill at 2:09 pm, Jan 23, 2023

LICENSE

#11805 MASTER ELECTRICIAN
Nicholaus Meyers

MODULE GROUNDING METHOD: ZEP SOLAR

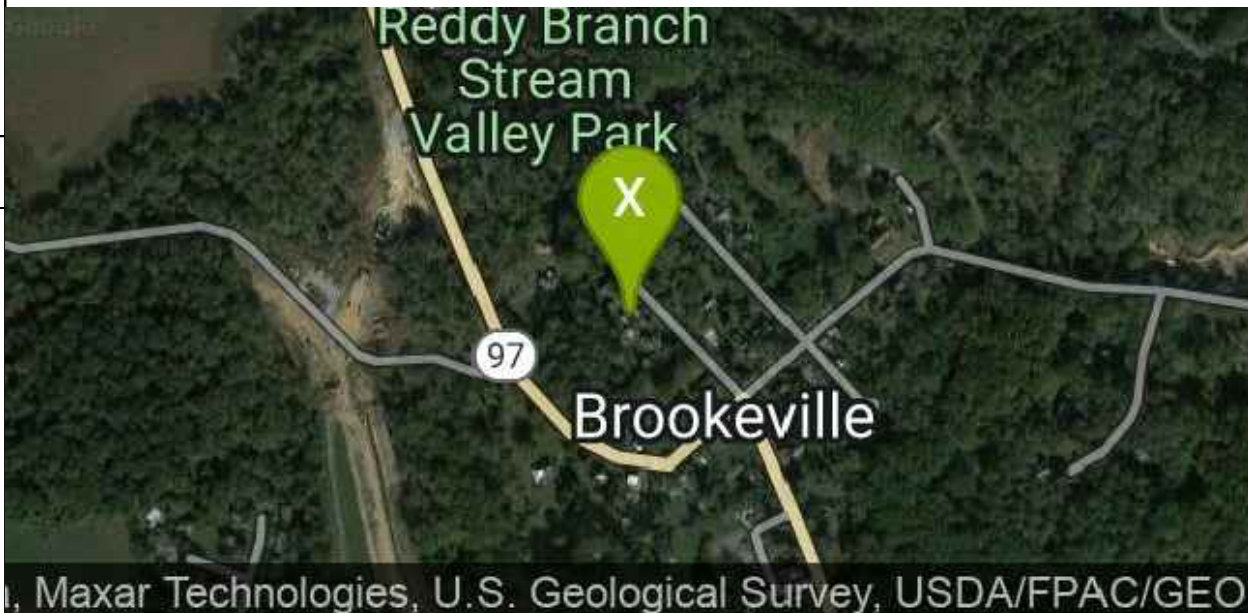
AHJ: Brookeville

UTILITY: PEPCO (MD)

GENERAL NOTES

1. ALL WORK SHALL COMPLY WITH THE 2018 IBC AND 2018 IRC. 2. ALL ELECTRICAL WORK SHALL COMPLY WITH THE 2017 NATIONAL ELECTRIC CODE.

VICINITY MAP



INDEX

Sheet 1	COVER SHEET
Sheet 2	SITE PLAN
Sheet 3	STRUCTURAL VIEWS
Sheet 4	STRUCTURAL VIEWS
Sheet 5	UPLIFT CALCULATIONS
Sheet 6	THREE LINE DIAGRAM
Sheet 7	THREE LINE DIAGRAM CONT.
Cutsheets Attached	

REV	BY	DATE	COMMENTS
REV A	NN	12/21/2022	TIE-IN UPDATED TO BUG. BOS LOC. UPDATED.
*	*	*	*
*	*	*	*
*	*	*	*
*	*	*	*

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JOB NUMBER: JB-20812139 00

MOUNTING SYSTEM: ZEP Standing Seam

MODULES: (14) Tesla # T400H

INVERTER: Powerwall+ [240V] #1850000-00-C / PVI Assy. 1538000-35-F

CUSTOMER: Jeffrey Johnson
106 Water St
Brookeville, MD 20833

2404473592

DESCRIPTION: 5.6 KW PV ARRAY
13.5 KWH ENERGY STORAGE SYSTEM

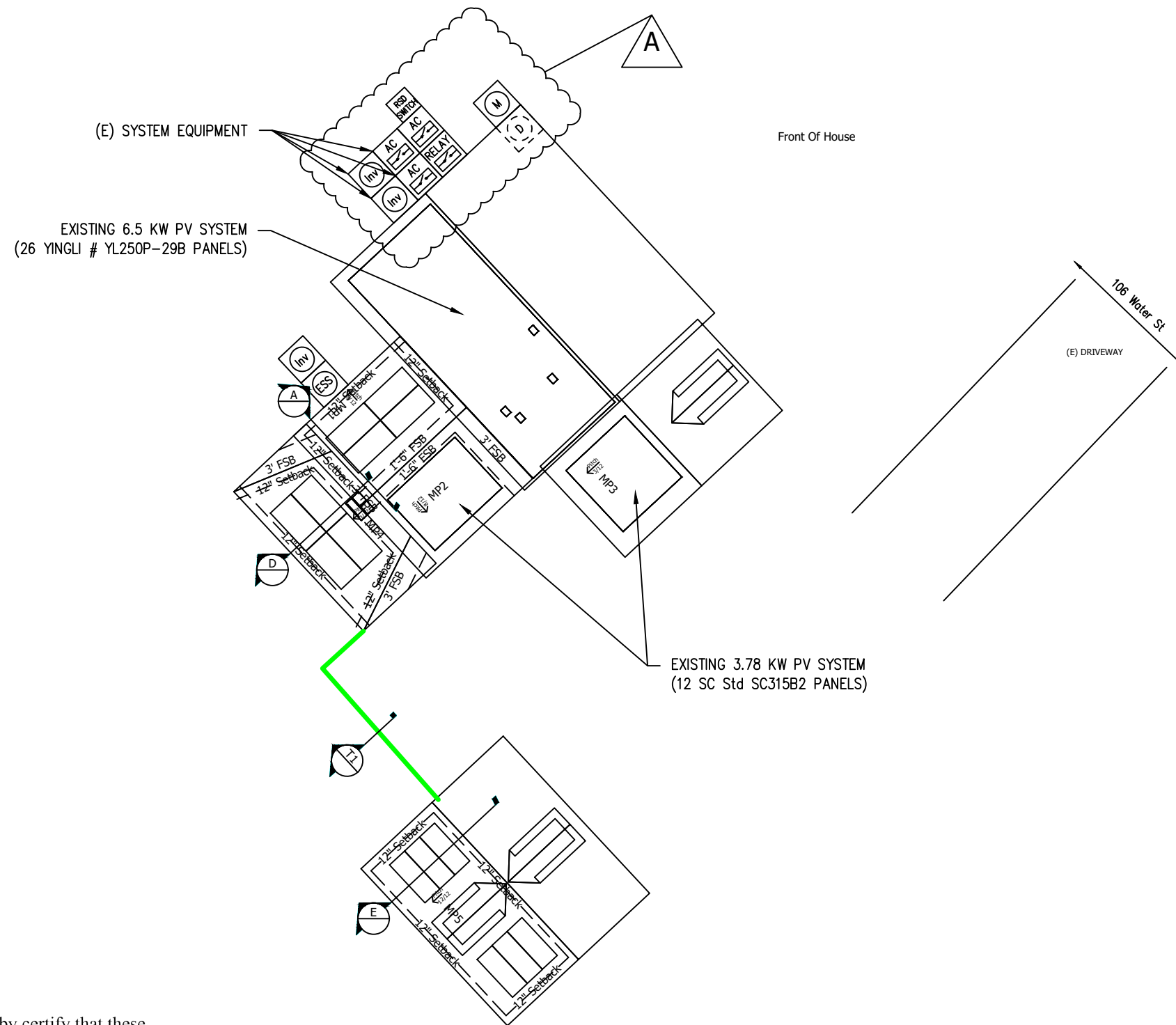
PAGE NAME: COVER SHEET

DESIGN: Nikola Nikolaev

SHEET: 1 REV: A DATE: 12/21/2022



House has a sprinkler system: NO



MP1	PITCH: 34° (8:12) ARRAY PITCH: 34° (8:12) AZIMUTH: 317 ARRAY AZIMUTH: 317 MATERIAL: Metal Standing Seam STORY: 2 Stories
MP2	PITCH: 34° (8:12) ARRAY PITCH: 34° (8:12) AZIMUTH: 137 ARRAY AZIMUTH: 137 MATERIAL: Metal Standing Seam STORY: 2 Stories
MP3	PITCH: 16° (3:12) ARRAY PITCH: 16° (3:12) AZIMUTH: 227 ARRAY AZIMUTH: 227 MATERIAL: Metal Standing Seam STORY: 2 Stories
MP4	PITCH: 14° (3:12) ARRAY PITCH: 14° (3:12) AZIMUTH: 227 ARRAY AZIMUTH: 227 MATERIAL: Metal Standing Seam STORY: 2 Stories
MP5	PITCH: 45° (12:12) ARRAY PITCH: 45° (12:12) AZIMUTH: 227 ARRAY AZIMUTH: 227 MATERIAL: Metal Standing Seam STORY: 2 Stories

LEGEND

- (E) UTILITY METER & WARNING LABEL
- INVERTER W/ INTEGRATED DC DISCO & WARNING LABELS
- AUTOMATIC RELAY
- DC DISCONNECT & WARNING LABELS
- AC DISCONNECT & WARNING LABELS
- DC JUNCTION/COMBINER BOX & LABELS
- ENERGY STORAGE SYSTEM FOR STAND ALONE OPERATION
- DISTRIBUTION PANEL & LABELS
- LOAD CENTER & WARNING LABELS
- DEDICATED PV SYSTEM METER
- RAPID SHUTDOWN
- STANDOFF LOCATIONS
- CONDUIT RUN ON EXTERIOR
- CONDUIT RUN ON INTERIOR
- GATE/FENCE
- HEAT PRODUCING VENTS ARE RED
- INTERIOR EQUIPMENT IS DASHED

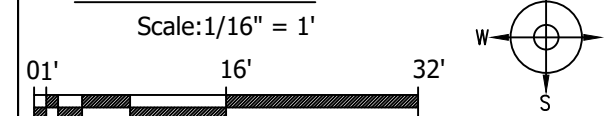
12/21/2022



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. 46671, Expiration Date: 05/18/2023

TOTAL ARRAY AREA (SF): 304
TOTAL ROOF AREA (SF): 3545
TOTAL ARRAY AREA IS ≈ 8.56 PERCENT OF TOTAL ROOF AREA

SITE PLAN



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MODULES: (14) Tesla # T400H
INVERTER: Powerwall+ [240V] #1850000-00-C / PVI Assy. 1538000-35-F

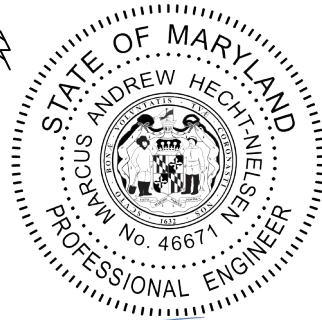
CUSTOMER: Jeffrey Johnson
106 Water St
Brookeville, MD 20833
2404473592

DESCRIPTION: 5.6 KW PV ARRAY
13.5 KWH ENERGY STORAGE SYSTEM
PAGE NAME: SITE PLAN

DESIGN: Nikola Nikolaev
SHEET: 2 REV: A DATE: 12/21/2022

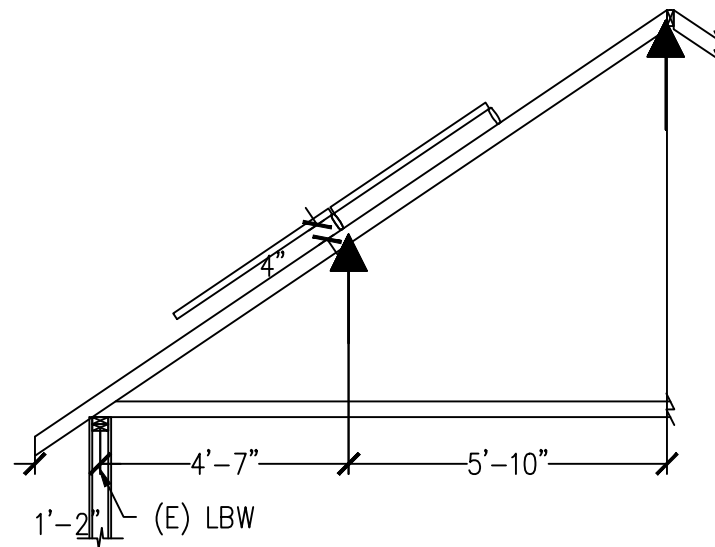


12/21/2022



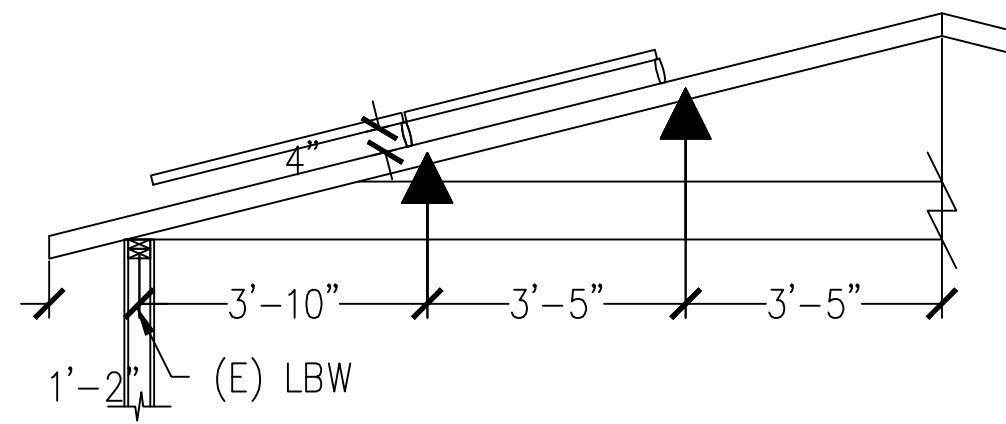
STRUCTURAL ONLY

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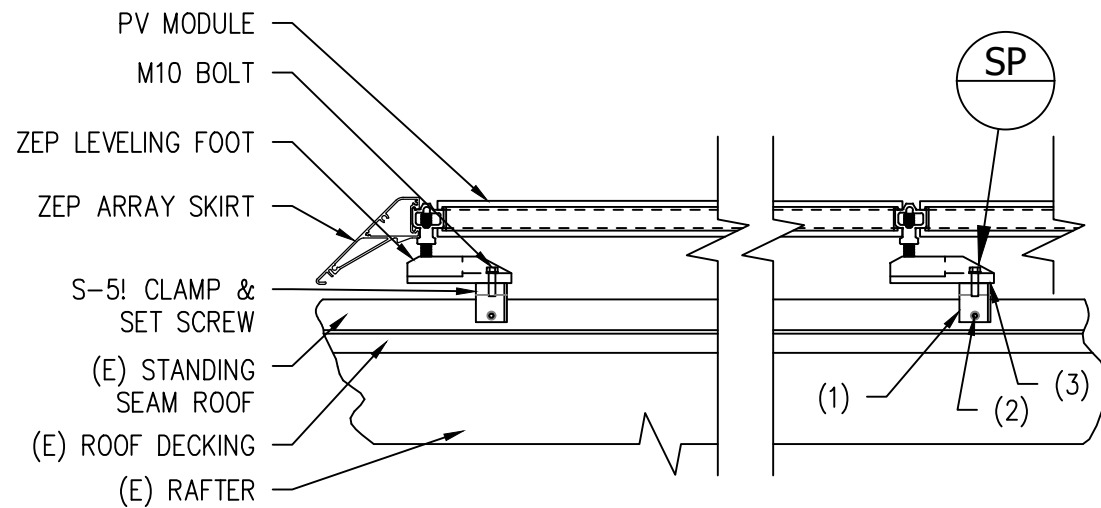
A SIDE VIEW OF MP1 NTS

MP1	ROOF AZI 317 PITCH 34	STORIES: 2
TOP CHORD 2x4 @ 24" OC	ARRAY AZI 317 PITCH 34	
BOT CHORD 2x4 @ 24" OC	Metal Standing Seam	



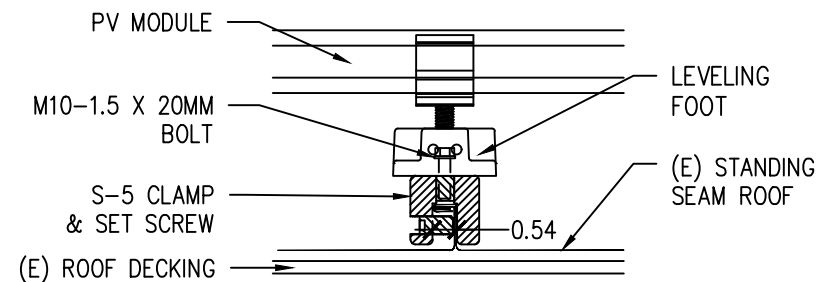
D SIDE VIEW OF MP4 NTS

MP4	ROOF AZI 227 PITCH 14	STORIES: 2
TOP CHORD 2x4 @ 24" OC	ARRAY AZI 227 PITCH 14	
BOT CHORD 2x10 @ 16" OC	Metal Standing Seam	



S1 STANDOFF
Scale: 1 1/2" = 1'

- INSTALLATION ORDER**
- LOCATE SEAM, MARK LOCATION, AND PLACE S-5! ON SEAM.
 - TIGHTEN SET SCREW(S) ON S-5! CLAMP.
 - INSTALL LEVELING FOOT ONTO S-5! CLAMP WITH BOLT & WASHERS.



SP S-5 DETAIL SHOWING SEAM PROFILE
Scale: 3"=1'-0"

INSTALL INSTRUCTIONS:
CLAMPS ARE MADE FOR TYP. STANDING SEAM PROFILES. WHEN ATTACHING THE MACHINE FOLDED SEAMS CLAMPS ARE DESIGNED TO ENGAGE THE SEAM. FOR HORIZONTAL SEAM APPLICATIONS THE SETSCREW MUST BE ACCESSIBLE FROM THE TOP FOR TIGHTENING.

ON MANY SNAP-TOGETHER TYPE SEAMS, THE SETSCREWS ARE OPPOSITE THE OPEN OR OVERLAP SIDE OF THE SEAM. ON SOME SEAMS THIS ASPECT OF THE CLAMP ORIENTATION IS NOT CRITICAL.

INSTALL WITH A SCREW GUN AND INCLUDED SCREW GUN BIT TIP. FOR OPTIMAL HOLDING STRENGTH. SETSCREWS SHOULD BE TENSIONED AND RE-TENSIONED AS THE SEAM MATERIAL COMPRESSES. SCREWS SHOULD BE TENSIONED TO 130 INCH POUNDS USING A CALIBRATED TORQUE WRENCH. THE S-5 HAS FOUR SETSCREWS LOCATIONS TO MAKE THE CLAMP MORE VERSATILE, HOWEVER ONLY TWO SETSCREWS ARE USED PER CLAMP. THE SETSCREWS SHOULD ALWAYS BE PLACED ON THE SAME SIDE OF THE CLAMP.

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JOB NUMBER: JB-20812139 00

MOUNTING SYSTEM:
ZEP Standing Seam

MODULES:
(14) Tesla # T400H

INVERTER:
Powerwall+ [240V] #1850000-00-C / PVI Assy. 1538000-35-F

CUSTOMER:
Jeffrey Johnson
106 Water St
Brookeville, MD 20833

2404473592

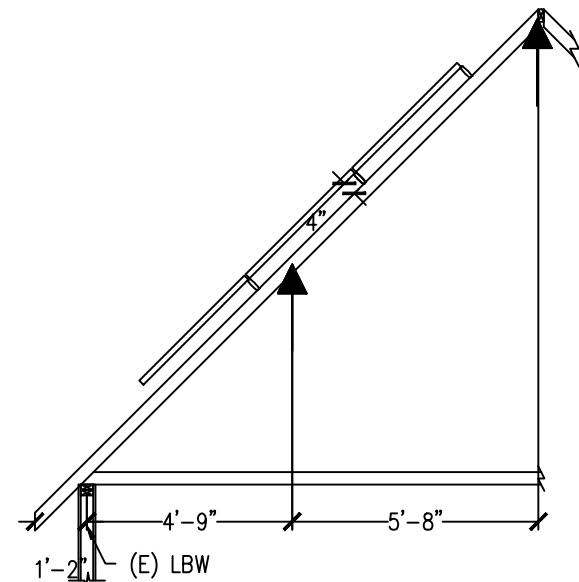
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5.6 KW PV ARRAY
13.5 KWH ENERGY STORAGE SYSTEM

PAGE NAME:
STRUCTURAL VIEWS

DESIGN:
Nikola Nikolaev

SHEET: 3 REV: A DATE: 12/21/2022





E SIDE VIEW OF MP5 NTS

MP5	ROOF AZI 227 PITCH 45 STORIES: 2
TOP CHORD 2x4 @ 24" OC	ARRAY AZI 227 PITCH 45
BOT CHORD 2x4 @ 24" OC	Metal Standing Seam

12/21/2022

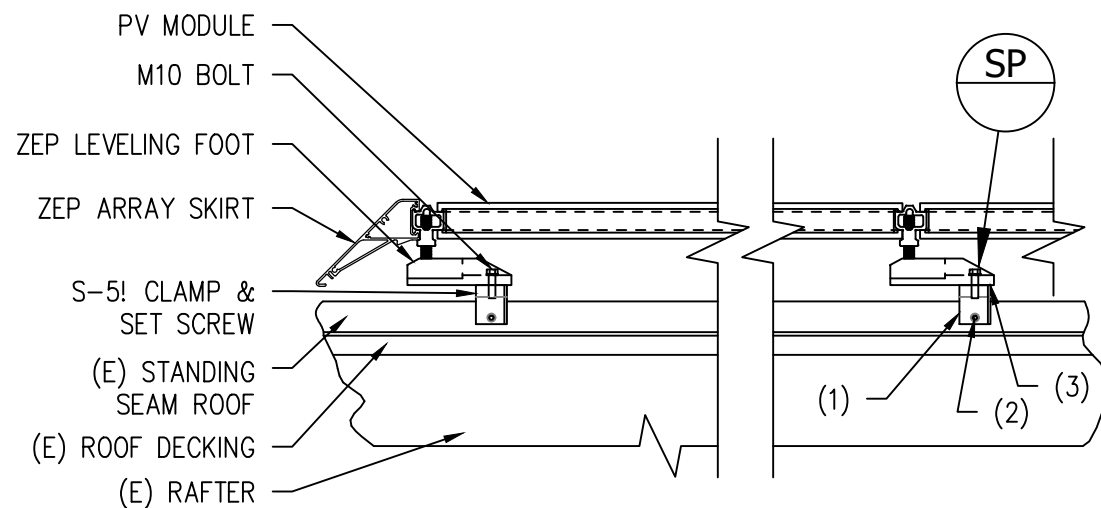


STRUCTURAL ONLY

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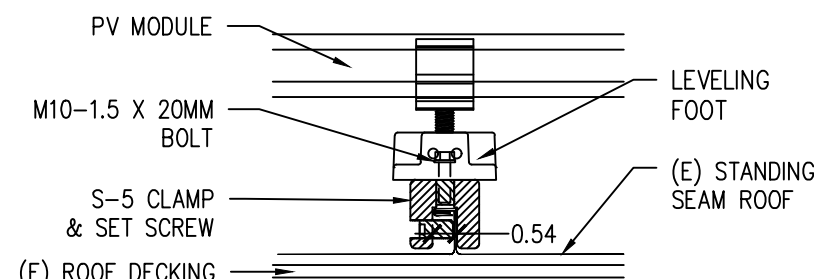


REVIEWED
By Winnie Cargill at 2:10 pm, Jan 23, 2023



S1 STANDOFF
Scale: 1 1/2" = 1'

- INSTALLATION ORDER**
- (1) LOCATE SEAM, MARK LOCATION, AND PLACE S-5! ON SEAM.
 - (2) TIGHTEN SET SCREW(S) ON S-5! CLAMP.
 - (3) INSTALL LEVELING FOOT ONTO S-5! CLAMP WITH BOLT & WASHERS.



SP S-5 DETAIL SHOWING SEAM PROFILE
Scale: 3"=1'-0"

INSTALL INSTRUCTIONS:
CLAMPS ARE MADE FOR TYP. STANDING SEAM PROFILES. WHEN ATTACHING THE MACHINE FOLDED SEAMS CLAMPS ARE DESIGNED TO ENGAGE THE SEAM. FOR HORIZONTAL SEAM APPLICATIONS THE SETSCREW MUST BE ACCESSIBLE FROM THE TOP FOR TIGHTENING.

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MOUNTING SYSTEM: ZEP Standing Seam
MODULES: (14) Tesla # T400H
INVERTER: Powerwall+ [240V] #1850000-00-C / PVI Assy. 1538000-35-F

CUSTOMER:
Jeffrey Johnson
106 Water St
Brookeville, MD 20833

2404473592

DESCRIPTION:
5.6 KW PV ARRAY
13.5 KWH ENERGY STORAGE SYSTEM

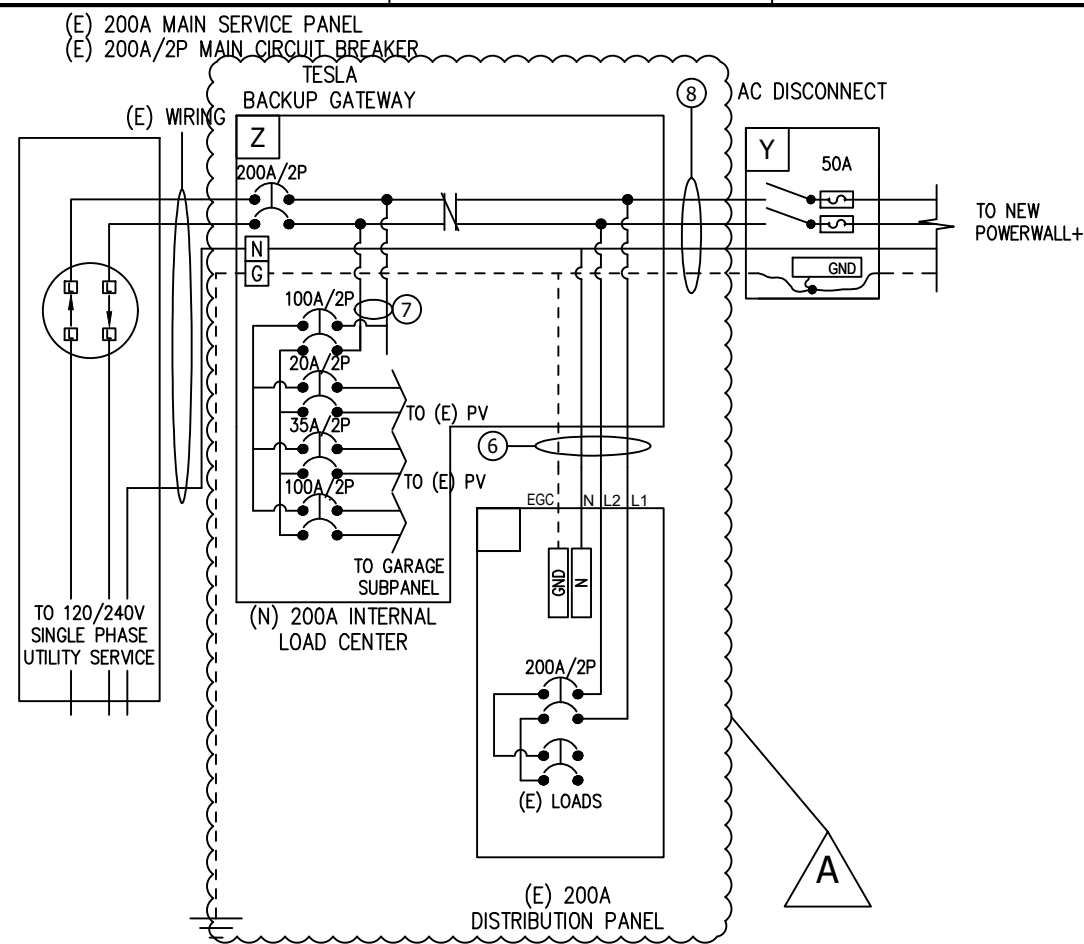
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STRUCTURAL VIEWS

DESIGN:
Nikola Nikolaev

SHEET: 4 REV: A DATE: 12/21/2022



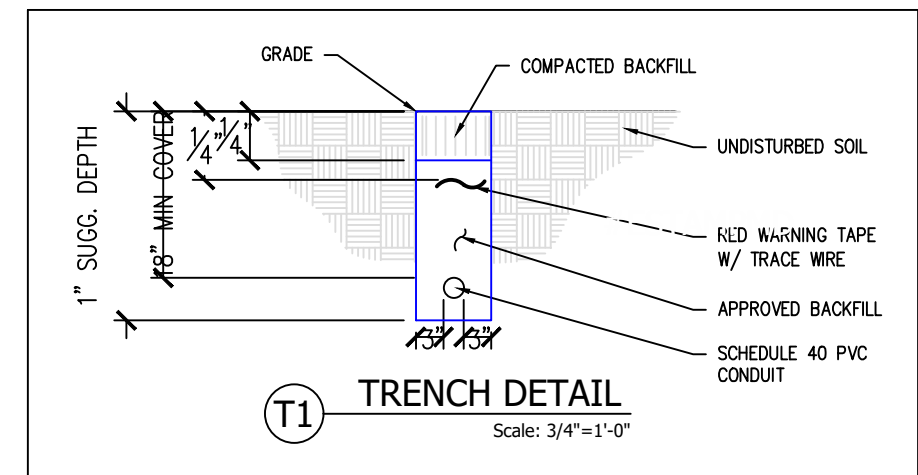
	MAIN PANEL SPECS Panel Number: NoLabel Meter Number: NXA113570193 Underground Service Entrance	GENERAL NOTES *		LICENSE #11805 MASTER ELECTRICIAN Nicholas Meyers
--	--	---------------------------	--	--



Wires are all Copper or Aluminum equivalent.

Panel Limit feature for Powerwall unit(s) to be utilized
 Field label to be at the point of interconnection:
 "PCS Controlled Current Setting: 200A"

The maximum output current from this system towards the main panel is controlled electronically. Refer to manufacturer's instructions for more information."



- Z** (1) Tesla # 1232100-00-G Back-up Gateway 2.0 NA for AC PW 2.0
 (1) Eaton # BW2200 200A Main Circuit Breaker; 2-Pole, 240V, 10kAIC
 (1) CUTLER-HAMMER # BR2100 Breaker; 100A/2P, 2 Spaces
 (1) Panelboard Accessory Kit for GW 2.0 NA 200A, 6sp/12cir, 120/240V, 1PH
- Y** (1) CUTLER-HAMMER #DS16FK Class R Fuse Kit
 (2) FERRAZ SHAWMUT # TR50R Fuse; 50A, 250V, Class RK5
 (1) CUTLER-HAMMER # DG100NB Ground/Neutral Kit; 60-100A, General Duty (DG)
 (1) CUTLER-HAMMER # DG222NRB Disconnect; 60A, 240Vac, Fusible, NEMA 3R
- X** (1) UL 508 Emergency Stop Device - NEMA 4X

- 6** (3) AWG #2/0, THWN-2, Black
 (1) AWG #6, THWN-2, Green
 (1) Conduit 2" PVC; Schedule 80
- 7** (1) AWG #3, THWN-2, White
 (1) AWG #3, THWN-2, Red
 (1) AWG #3, THWN-2, Black - (1) AWG #8, THWN-2, Green
- 8** (1) AWG #6, THWN-2, White
 (1) AWG #6, THWN-2, Red
 (1) AWG #6, THWN-2, Black
 (1) AWG #10, THWN-2, Green - (1) Conduit Kit; 3/4" EMT

AC

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JOB NUMBER: JB-20812139 00
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 MODULES: (14) Tesla # T400H
 INVERTER: Powerwall+ [240V] #1850000-00-C / PVI Assy. 1538000-35-F

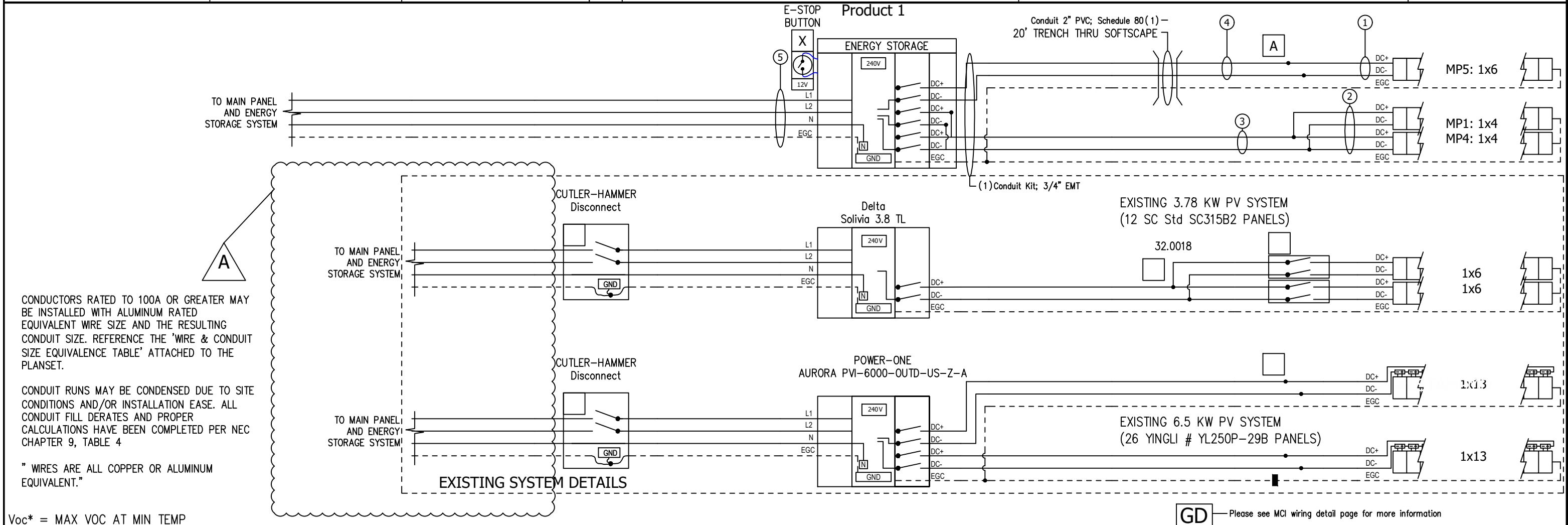
CUSTOMER: Jeffrey Johnson
 106 Water St
 Brookeville, MD 20833
 2404473592

DESCRIPTION: 5.6 KW PV ARRAY
 13.5 KWH ENERGY STORAGE SYSTEM
 PAGE NAME: THREE LINE DIAGRAM

DESIGN: Nikola Nikolaev
 SHEET: 6 REV: A DATE: 12/21/2022



MAIN PANEL SPECS	GENERAL NOTES	PRODUCT SPECS	MODULE SPECS	LICENSE
Panel Number: Meter Number:	Inv 1: DC Ungrounded	1 - (1) Powerwall+ [240V] #1850000-00-C / PVI Assy. 1538000-35-F 2 3	(14) Tesla # T400H PV Module, 400W, 371.5 PTC, 40MM, Black Frame, MC4/MC4-EV02, ZEP, 1000V Voc: 45.3 Vpmax: 37.13 Isc AND Imp ARE SHOWN IN THE DC STRINGS IDENTIFIER	#11805 MASTER ELECTRICIAN Nicholaus Meyers



AC	DC
<p>5 (1) AWG #8, THWN-2, Black - (1) AWG #8, THWN-2, White (1) AWG #8, THWN-2, Red (1) AWG #10, THWN-2, Green EGC Vmp = 240 VAC Imp = 32 AAC (1) Conduit Kit; 3/4" EMT</p>	<p>3 (2) PV Wire, AWG 10 Voc* = 205.66VDC Isc = 22.28 ADC (1) AWG #10, Solid Bare Copper EGC Vmp = 148.52 VDC Imp = 21.54 ADC (1) Conduit Kit; 3/4" EMT</p> <p>4 (2) PV Wire, AWG 10 Voc* = 308.49VDC Isc = 11.14 ADC (1) AWG #10, Solid Bare Copper EGC Vmp = 222.78VDC Imp = 10.77 ADC (1) Conduit Kit; 3/4" EMT</p>
	<p>1 (2) PV Wire, AWG 10 Voc* = 308.49VDC Isc = 11.14 ADC (1) AWG #10, THHN/THWN-2, Green EGC Vmp = 222.78VDC Imp = 10.77 ADC (1) Conduit Kit; 3/4" EMT</p> <p>2 (4) PV Wire, AWG 10 Voc* = 205.66VDC Isc = 11.14 ADC (1) AWG #10, THHN/THWN-2, Green EGC Vmp = 148.52 VDC Imp = 10.77 ADC (1) Conduit Kit; 3/4" EMT</p>

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	<p>MOUNTING SYSTEM: ZEP Standing Seam</p> <p>MODULES: (14) Tesla # T400H</p> <p>INVERTER: Powerwall+ [240V] #1850000-00-C / PVI Assy. 1538000-35-F</p>	<p>2404473592</p>	<p>PAGE NAME: THREE LINE DIAGRAM CONT.</p>	<p>SHEET: 7 REV: A DATE: 12/21/2022</p>	

WARNING: PHOTOVOLTAIC POWER SOURCE

Label Location:
(C)(CB)(JB)
Per Code:
NEC 690.31.G.3

PHOTOVOLTAIC DC
DISCONNECT

Label Location:
(DC) (INV)
Per Code:
NEC 690.13.B

WARNING

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

Label Location:
(AC)(POI)
Per Code:
NEC 690.13.B

WARNING

ELECTRIC SHOCK HAZARD
THE DC CONDUCTORS OF THIS
PHOTOVOLTAIC SYSTEM ARE
UNGROUNDDED AND
MAY BE ENERGIZED

Label Location:
(DC) (INV)

MAXIMUM POWER-
POINT CURRENT (Imp) A
MAXIMUM POWER-
POINT VOLTAGE (Vmp) V
MAXIMUM SYSTEM
VOLTAGE (Voc) V
SHORT-CIRCUIT
CURRENT (Isc) A

Label Location:
(DC) (INV)
Per Code:
NEC 690.53

PHOTOVOLTAIC SYSTEM
EQUIPPED WITH RAPID
SHUTDOWN

Label Location:
(INV)
Per Code:
NEC 690.56.C.3

WARNING

INVERTER OUTPUT
CONNECTION
DO NOT RELOCATE
THIS OVERCURRENT
DEVICE

Label Location:
(POI)
Per Code:
NEC 705.12.B.2.3.b

WARNING

ELECTRIC SHOCK HAZARD
IF A GROUND FAULT IS INDICATED
NORMALLY GROUNDED
CONDUCTORS MAY BE
UNGROUNDDED AND ENERGIZED

Label Location:
(DC) (INV)
Per Code:
690.41.B

CAUTION

PHOTOVOLTAIC SYSTEM
CIRCUIT IS BACKFED

Label Location:
(D) (POI)
Per Code:
NEC 690.64.B.4

WARNING

ELECTRICAL SHOCK HAZARD
DO NOT TOUCH TERMINALS
TERMINALS ON BOTH LINE AND
LOAD SIDES MAY BE ENERGIZED
IN THE OPEN POSITION
DC VOLTAGE IS
ALWAYS PRESENT WHEN
SOLAR MODULES ARE
EXPOSED TO SUNLIGHT

Label Location:
(DC) (CB)
Per Code:
CEC 690.13.B

CAUTION

DUAL POWER SOURCE
SECOND SOURCE IS
PHOTOVOLTAIC SYSTEM

Label Location:
(POI)
Per Code:
NEC 705.12.B.3

PHOTOVOLTAIC AC
DISCONNECT

Label Location:
(AC) (POI)
Per Code:
NEC 690.13.B

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

Label Location:
(POI)
Per Code:
CEC 690.13.B

MAXIMUM AC
OPERATING CURRENT A
MAXIMUM AC
OPERATING VOLTAGE V

Label Location:
(AC) (POI)
Per Code:
NEC 690.54

MAXIMUM AC
OPERATING CURRENT A
MAXIMUM AC
OPERATING VOLTAGE V

(AC): AC Disconnect
(C): Conduit
(CB): Combiner Box
(D): Distribution Panel
(DC): DC Disconnect
(IC): Interior Run Conduit
(INV): Inverter With Integrated DC Disconnect
(LC): Load Center
(M): Utility Meter
(POI): Point of Interconnection

BACKUP LOAD CENTER

Label Location:
(BLC)
Per Code:
NEC 408.4

CAUTION
TRI POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM
THIRD SOURCE IS ENERGY STORAGE SYSTEM

Label Location:
(MSP)
Per Code:
NEC 705.12(B)(3)

CAUTION
DO NOT ADD NEW LOADS

Label Location:
(BLC)
Per Code:
NEC 220

WARNING

THIS EQUIPMENT FED BY
MULTIPLE SOURCES. TOTAL
RATING OF ALL OVER CURRENT
DEVICES, EXCLUDING MAIN
SUPPLY OVERCURRENT DEVICE,
SHALL NOT EXCEED AMPACITY
OF BUSBAR.

Label Location:
(MSP)
Per Code:
NEC 705.12.B.2.3.c

CAUTION
THIS PANEL HAS SPLICED FEED-
THROUGH CONDUCTORS.
LOCATION OF DISCONNECT AT ENERGY
STORAGE BACKUP LOAD PANEL

Label Location:
(MSP)
Per Code:
NEC 312.8.A(3)

CAUTION
DUAL POWER SOURCE
SECOND SOURCE IS
ENERGY STORAGE SYSTEM

Label Location:
(MSP)
Per Code:
NEC 705.12(B)(3)

NOMINAL ESS VOLTAGE: 120/240V
**MAX AVAILABLE SHORT-
CIRCUIT FROM ESS:** 32A
**ARC FAULT CLEARING
TIME FROM ESS:** 67ms
**DATE OF
CALCULATION:**

Label Location:
(MSP)
Per Code:
Per 706.7(D) label to be marked in field

ENERGY STORAGE SYSTEM ON SITE
LOCATED WITHIN LINE OF SIGHT

Label Location:
(MSP)
Per Code:

ENERGY STORAGE SYSTEM ON SITE
LOCATED ON ADJACENT WALL

Label Location:
(MSP)
Per Code:

ENERGY STORAGE SYSTEM ON SITE
LOCATED ON OPPOSITE WALL

Label Location:
(MSP)
Per Code:

ENERGY STORAGE SYSTEM ON SITE
LOCATED INSIDE

Label Location:
(MSP)
Per Code:

(AC): AC Disconnect
(BLC): Backup Load Center
(MSP): Main Service Panel

Label Set

S-5! Attachment Hardware

Modern standing seam roofing systems boast that by design, fastening through the weathering membrane is greatly reduced or eliminated. Unfortunately, when it becomes necessary to attach something to the roof, there has never been a way to do it without compromising roof integrity and voiding system warranties. Such attachments have in the past been the source of leaks, panel corrosion and repeated maintenance problems.

Look at all the things you don't get with S-5!

- no holes
- no panel damage
- no maintenance
- no leaks
- no wood blocking
- no hassles
- no corrosion
- no violation of thermal movement
- no callbacks
- no caulking
- no warranty violation
- NO PROBLEMS

The S-5! clamp systems now offer a complete solution to the attachment of a wide variety of ancillary rooftop accessories, including [HVAC equipment](#), [signage](#), solar panels, [snow retention hardware](#), [gas piping and conduit](#), rooftop lighting, fascias, [equipment screens](#), [parapet bracing](#), condensate lines, [stack and flue bracing](#), antennae, roof walkways and more.

A variety of S-5! clamp styles are available:



- The [S-5-U](#) will fit most "structural" and "architectural" panel seam styles.
- The [S-5-Z](#) is specially designed to fit ZipRib, Kal-Zip and similar profiles.
- The [S-5-B](#) is a brass clamp, designed for use on double-folded standing seam or traditional batten seam copper.
- The [S-5-E](#) is an aluminum clamp designed to fit traditional double-folded standing seam profiles.

Metal Roof Innovations, Ltd., also develops custom clamps. We invite you to [Contact Us](#) with inquiries about special requirements.

Aluminum clamps are metallurgically compatible with bare or painted galvanized, Galvalume, Aluminized and Galfan coated steel, as well as bare or painted aluminum, stainless and zinc sheet products. In most applications, the clamp should be installed at a location on the seam that avoids the panel's attachment clip location. S-5! clamps may also be used at a clip location, provided the clip is an expansion (dual-component) clip. All aluminum clamps are furnished with a stainless steel bolt and washer (3/8" diameter x 5/8" length; bolt head size is 9/16").

For more detailed installation instructions, see the [Installation](#) section.

S-5! clamps attach to the panel seam by the tightening of two "bullet-nosed" stainless steel set screws

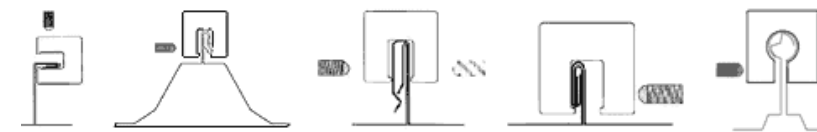
against the seam material (this is usually done with an industrial grade screwgun). The set screws compress the seam material against the opposite wall of the clamp. They will "dimple" the seam material, but will not penetrate it. Threaded holes in the clamp (and stainless hardware provided) enable the easy attachment of various ancillary items to the clamps.



S-5-U on a vertical seam

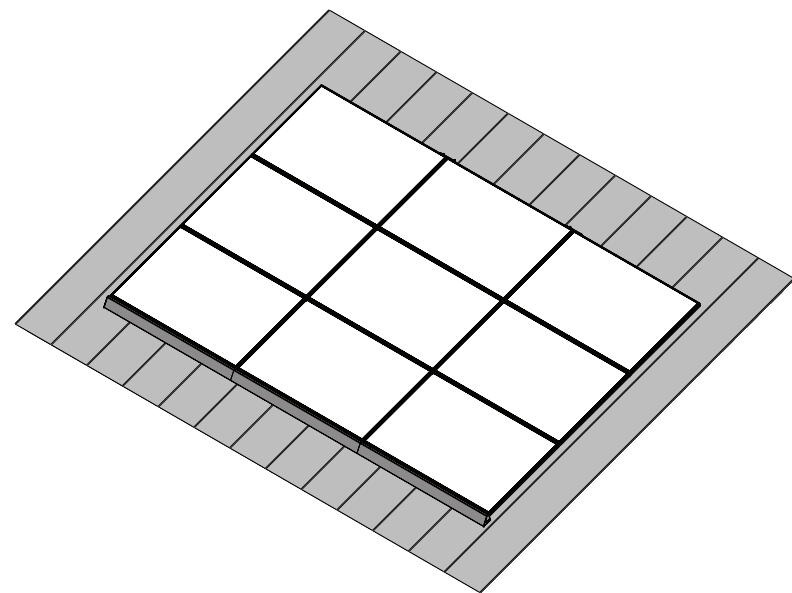


S-5-U on a horizontal seam



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ZS Seam
for standing seam metal roofs



Description

- PV mounting solution for standing seam metal roofs
- Works with all Zep Compatible Modules
- Auto bonding UL-listed hardware creates structural and electrical bond

Specifications

- Designed for pitched roofs
- Installs in portrait and landscape orientations
- ZS Seam grounding products are UL listed to UL 2703 and UL 467
- ZS Seam bonding products are UL listed to UL 2703
- Engineered for spans up to 72' and cantilevers up to 24'
- Zep wire management products listed to UL 1565 for wire positioning devices

zepsolar.com

This document does not create any express warranty by Zep Solar or about its products or services. Zep Solar's sole warranty is contained in the written product warranty for each product. The end-user documentation shipped with Zep Solar's products constitutes the sole specifications referred to in the product warranty. The customer is solely responsible for verifying the suitability of ZepSolar's products for each use. Specifications are subject to change without notice. Patents and Apps: zspats.com.

Components

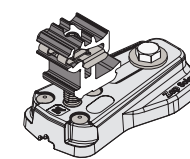


**Seam Mount
S-5-U, S or N**

OR

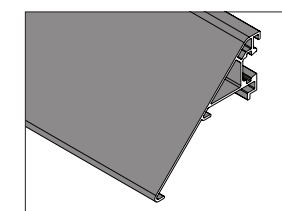


**Seam Mount
Ace Clamp A-2**



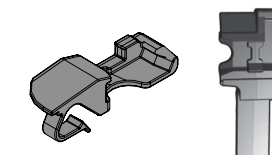
Leveling Foot

Part No. 850-1397
Listed to UL 2703



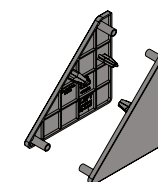
Array Skirt

Part No. 850-1608 or 500-0113
Listed to UL 2703



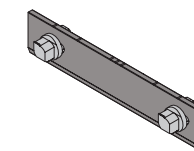
Grip

Part No. 850-1606 or 850-1421
Listed to UL 2703



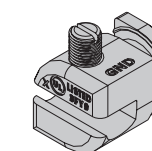
End Cap

Part No.
(L) 850-1586 or 850-1460
(R) 850-1588 or 850-1467
Listed to UL 2703



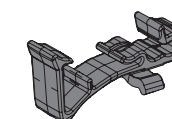
Interlock

Part No. 850-1388 or 850-1613
Listed to UL 2703



Ground Zep V2

Part No. 850-1511
Listed to UL 467 and UL 2703



DC Wire Clip

Part No. 850-1509
Listed to UL 1565

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POWERWALL

Backup Gateway 2

The Backup Gateway 2 for Tesla Powerwall provides energy management and monitoring for solar self-consumption, time-based control, and backup.

The Backup Gateway 2 controls connection to the grid, automatically detecting outages and providing a seamless transition to backup power. When equipped with a main circuit breaker, the Backup Gateway 2 can be installed at the service entrance. When the optional internal panelboard is installed, the Backup Gateway 2 can also function as a load center.

The Backup Gateway 2 communicates directly with Powerwall, allowing you to monitor energy use and manage backup energy reserves from any mobile device with the Tesla app.



PERFORMANCE SPECIFICATIONS

Model Number	1232100-xx-y
AC Voltage (Nominal)	120/240V
Feed-In Type	Split Phase
Grid Frequency	60 Hz
Current Rating	200 A
Maximum Input Short Circuit Current	10 kA ¹
Overcurrent Protection Device	100-200A; Service Entrance Rated ¹
Overvoltage Category	Category IV
AC Meter	Revenue accurate (+/- 0.2 %)
Primary Connectivity	Ethernet, Wi-Fi
Secondary Connectivity	Cellular (3G, LTE/4G) ²
User Interface	Tesla App
Operating Modes	Support for solar self-consumption, time-based control, and backup
Backup Transition	Automatic disconnect for seamless backup
Modularity	Supports up to 10 AC-coupled Powerwalls
Optional Internal Panelboard	200A 6-space / 12 circuit Eaton BR Circuit Breakers
Warranty	10 years

¹ When protected by Class J fuses, Backup Gateway 2 is suitable for use in circuits capable of delivering not more than 22kA symmetrical amperes.

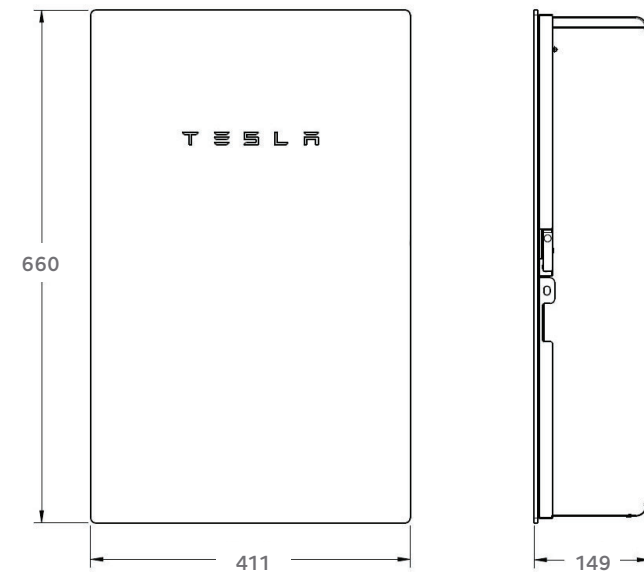
² The customer is expected to provide internet connectivity for Backup Gateway 2; cellular should not be used as the primary mode of connectivity. Cellular connectivity subject to network operator service coverage and signal strength.

COMPLIANCE INFORMATION

Certifications	UL 67, UL 869A, UL 916, UL 1741 PCS CSA 22.2 0.19, CSA 22.2 205
Emissions	FCC Part 15, ICES 003

MECHANICAL SPECIFICATIONS

Dimensions	660 mm x 411 mm x 149 mm (26 in x 16 in x 6 in)
Weight	20.4 kg (45 lb)
Mounting options	Wall mount, Semi-flush mount



ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	-20°C to 50°C (-4°F to 122°F)
Operating Humidity (RH)	Up to 100%, condensing
Maximum Elevation	3000 m (9843 ft)
Environment	Indoor and outdoor rated
Enclosure Type	NEMA 3R

MCI WIRING DETAIL

GENERAL NOTES

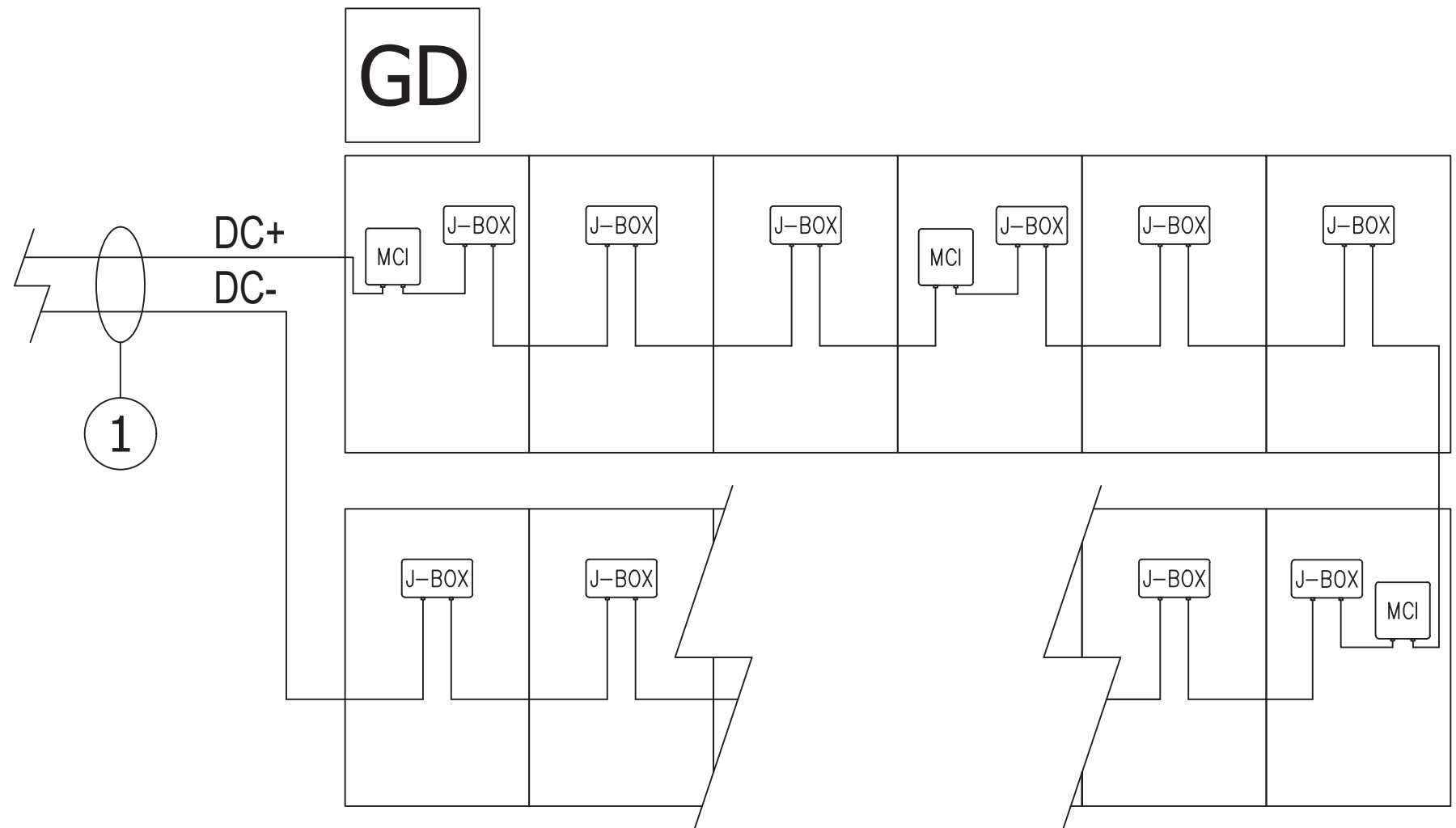
- DRAWING OF STANDARD MCI WIRING DETAIL FOR ANY GIVEN STRING LENGTH
- IF INITIATED, RAPID SHUTDOWN OCCURS WITHIN 30 SECONDS OF ACTIVATION AND LIMITS VOLTAGE ON THE ROOF TO NO GREATER THAN 165V (690.12.B.2.1)
- MID CIRCUIT INTERRUPTER (MCI) IS A UL 1741 PVRSE CERTIFIED RAPID SHUTDOWN DEVICE (RSD)

RETROFIT PV MODULES

- MCIS ARE LOCATED AT ROOF LEVEL, JUST UNDER THE PV MODULES IN ACCORDANCE WITH 690.12 REQUIREMENTS
- THE QUANTITY OF MCIS PER STRING IS DETERMINED BY STRING LENGTH
 - NUMBER OF MODULES BETWEEN MCI UNITS = 0-3
 - MAXIMUM NUMBER OF MODULES PER MCI UNIT = 3
 - MINIMUM NUMBER MCI UNITS = MODULE COUNT/3

*Exception: Tesla (Longi) modules installed in locations where the max Voc for 3 modules at low design temperature exceeds 165V shall be limited to 2 modules between MCIs.

PLEASE REFER TO MCI CUTSHEET AND PVRSA INSERT FOR MORE INFORMATION



① (2)AWG, PV Wire, 600V, Black

DC



POWERWALL+

Powerwall+ is an integrated solar battery system that stores energy from solar production. Powerwall+ has two separate inverters, one for battery and one for solar, that are optimized to work together. Its integrated design and streamlined installation allow for simple connection to any home, and improved surge power capability brings whole home backup in a smaller package. Smart system controls enable owners to customize system behavior to suit their renewable energy needs.

KEY FEATURES

- Integrated battery, inverter, and system controller for a more compact install
- A suite of application modes, including self-powered, time-based control, and backup modes
- Wi-Fi, Ethernet, and LTE connectivity with easy over-the-air updates

NA 2022-05-06

POWERWALL+

PHOTOVOLTAIC (PV) AND BATTERY ENERGY STORAGE SYSTEM (BESS) SPECIFICATIONS

Powerwall+ Model Number	1850000-xx-y
Solar Assembly Model Number	1538000-xx-y
Nominal Battery Energy	13.5 kWh
Nominal Grid Voltage (Input / Output)	120/240 VAC
Grid Voltage Range	211.2 - 264 VAC
Frequency	60 Hz
Phase	240 VAC: 2W+N+GND
Maximum Continuous Power On-Grid	7.6 kVA full sun / 5.8 kVA no sun ¹
Maximum Continuous Power Off-Grid	9.6 kW full sun / 7 kW no sun ¹
Peak Off-Grid Power (10 s)	22 kW full sun / 10 kW no sun ¹
Maximum Continuous Current On-Grid	32 A output
Maximum Continuous Current Off-Grid	40 A output
Load Start Capability	98 - 118 A LRA ²
PV Maximum Input Voltage	600 VDC
PV DC Input Voltage Range	60 - 550 VDC
PV DC MPPT Voltage Range	60 - 480 VDC
MPPTs	4
Input Connectors per MPPT	1-2-1-2
Maximum Current per MPPT (I_{mp})	13 A ³
Maximum Short Circuit Current per MPPT (I_{sc})	17 A ³
Allowable DC/AC Ratio	1.7
Overcurrent Protection Device	50 A breaker
Maximum Supply Fault Current	10 kA
Output Power Factor Rating	+/- 0.9 to 1 ⁴
Round Trip Efficiency	90% ⁵
Solar Generation CEC Efficiency	97.5% at 208 V 98.0% at 240 V
Customer Interface	Tesla Mobile App
Internet Connectivity	Wi-Fi, Ethernet, Cellular LTE/4G ⁶
PV AC Metering	Revenue grade (+/-0.5%)
Protections	Integrated arc fault circuit interrupter (AFCI), PV Rapid Shutdown
Warranty	10 years

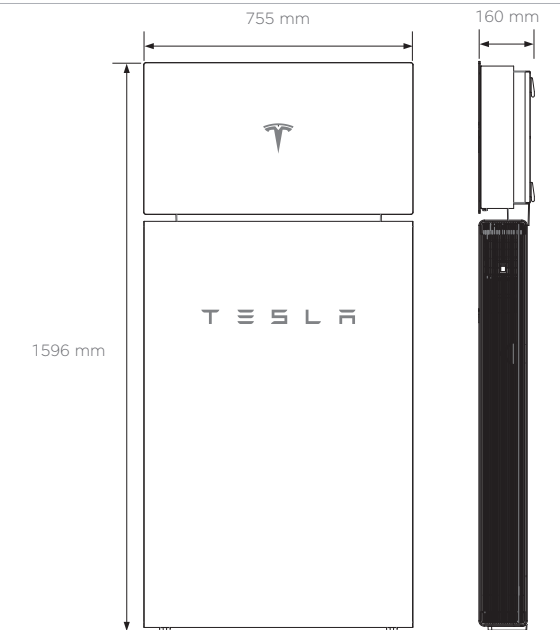
COMPLIANCE INFORMATION

PV Certifications	UL 1699B, UL 1741, UL 3741, UL 1741 SA, UL 1998 (US), IEEE 1547, IEEE 1547.1
Battery Energy Storage System Certifications	UL 1642, UL 1741, UL 1741 PCS, UL 1741 SA, UL 1973, UL 9540, IEEE 1547, IEEE 1547.1, UN 38.3
Grid Connection	United States
Emissions	FCC Part 15 Class B
Environmental	RoHS Directive 2011/65/EU
Seismic	AC156, IEEE 693-2005 (high)

TESLA

MECHANICAL SPECIFICATIONS

Dimensions	1596 x 755 x 160 mm (62.8 x 29.7 x 6.3 in)
Total Weight	140 kg (310 lb) ⁷
Battery Assembly	118 kg (261 lb)
Solar Assembly	22 kg (49 lb)
Mounting options	Floor or wall mount



ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	-20°C to 50°C (-4°F to 122°F) ⁸
Recommended Temperature	0°C to 30°C (32°F to 86°F)
Operating Humidity (RH)	Up to 100%, condensing
Storage Conditions	-20°C to 30°C (-4°F to 86°F) Up to 95% RH, non-condensing State of Energy (SoE): 25% initial
Maximum Elevation	3000 m (9843 ft)
Environment	Indoor and outdoor rated
Enclosure Type	Type 3R
Solar Assembly Ingress Rating	IP55 (Wiring Compartment)
Battery Assembly Ingress Rating	IP56 (Wiring Compartment) IP67 (Battery & Power Electronics)
Noise Level @ 1 m	< 40 db(A) optimal, < 50 db(A) maximum

¹Values provided for 25°C (77°F).

²Load start capability may vary.

³Where the DC input current exceeds an MPPT rating, jumpers can be used to allow a single MPPT to intake additional DC current up to 26 A I_{mp} / 34 A I_{sc} .

⁴Power factor rating at max real power.

⁵AC to battery to AC, at beginning of life.

⁶Cellular connectivity subject to network service coverage and signal strength.

⁷The total weight does not include the Powerwall+ bracket, which weighs an additional 9 kg (20 lb).

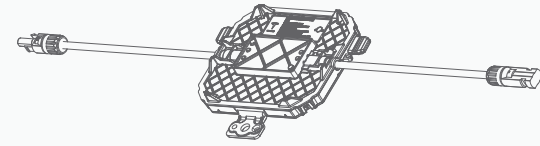
⁸Performance may be de-rated at operating temperatures below 10°C (50°F) or greater than 43°C (109°F).

NA 2022-05-06

TESLA.COM/ENERGY

SOLAR SHUTDOWN DEVICE

The Tesla Solar Shutdown Device is a Mid-Circuit Interrupter (MCI) and is part of the PV system rapid shutdown (RSD) function in accordance with Article 690 of the applicable NEC. When paired with Powerwall+, solar array shutdown is initiated by pushing the System Shutdown Switch if one is present.



ELECTRICAL SPECIFICATIONS

Model Number	MCI-1
Nominal Input DC Current Rating (I_{MP})	12 A
Maximum Input Short Circuit Current (I_{SC})	15 A
Maximum System Voltage	600 V DC

RSD MODULE PERFORMANCE

Maximum Number of Devices per String	5
Control	Power Line Excitation
Passive State	Normally open
Maximum Power Consumption	7 W
Warranty	25 years

COMPLIANCE INFORMATION

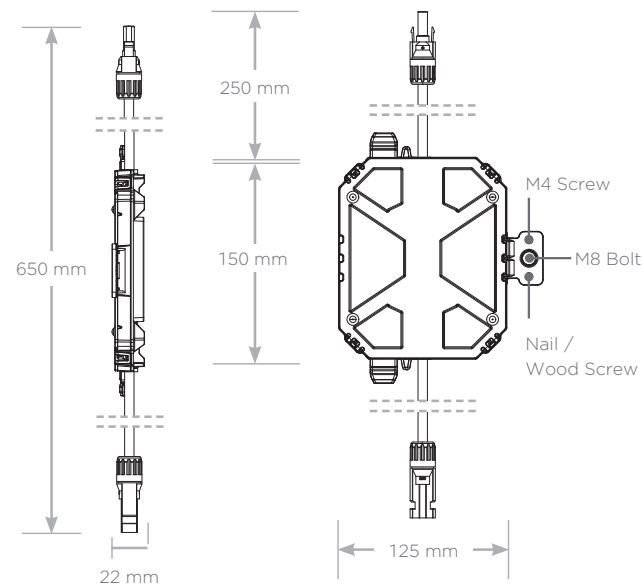
Certifications	UL 1741 PVRSE, UL 3741, PVRSA (Photovoltaic Rapid Shutdown Array)
RSD Initiation Method	External System Shutdown Switch
Compatible Equipment	See Compatibility Table below

ENVIRONMENTAL SPECIFICATIONS

Ambient Temperature	-40°C to 50°C (-40°F to 122°F)
Storage Temperature	-30°C to 60°C (-22°F to 140°F)
Enclosure Rating	NEMA 4 / IP65

MECHANICAL SPECIFICATIONS

Electrical Connections	MC4 Connector
Housing	Plastic
Dimensions	125 mm x 150 mm x 22 mm (5 in x 6 in x 1 in)
Weight	350 g (0.77 lb)
Mounting Options	ZEP Home Run Clip M4 Screw (#10) M8 Bolt (5/16") Nail / Wood screw



UL 3741 PV HAZARD CONTROL (AND PVRSA) COMPATIBILITY

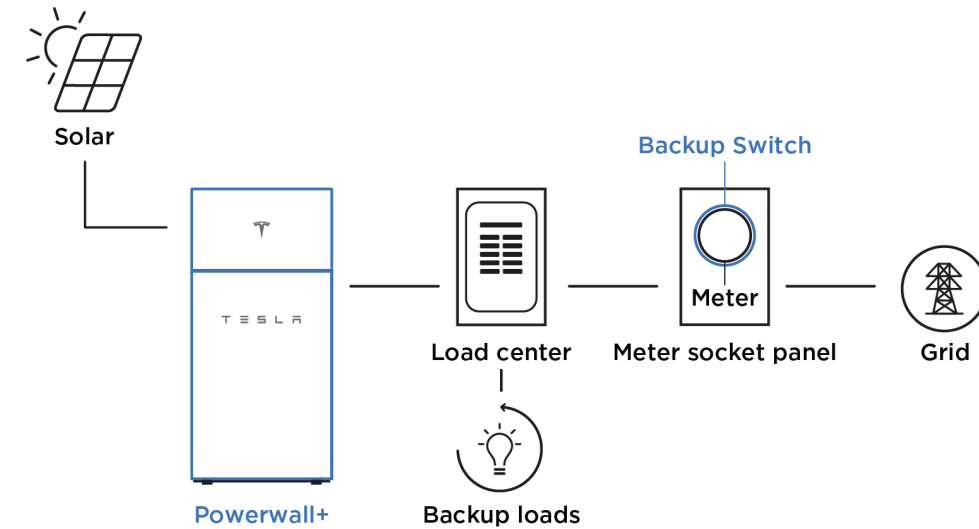
Tesla Solar Roof and Tesla/Zep ZS Arrays using the following modules are certified to UL 3741 and UL 1741 PVRSA when installed with the Powerwall+ and Solar Shutdown Devices. See the Powerwall+ Installation Manual for detailed instructions and for guidance on installing Powerwall+ and Solar Shutdown Devices with other modules.

Brand	Model	Required Solar Shutdown Devices
Tesla	Solar Roof V3	1 Solar Shutdown Device per 10 modules
Tesla	Tesla TxxxS (where xxx = 405 to 450 W, increments of 5)	1 Solar Shutdown Device per 3 modules ¹
Tesla	Tesla TxxxH (where xxx = 395 to 415 W, increments of 5)	1 Solar Shutdown Device per 3 modules
Hanwha	Q.PEAK DUO BLK-G5	1 Solar Shutdown Device per 3 modules
Hanwha	Q.PEAK DUO BLK-G6+	1 Solar Shutdown Device per 3 modules

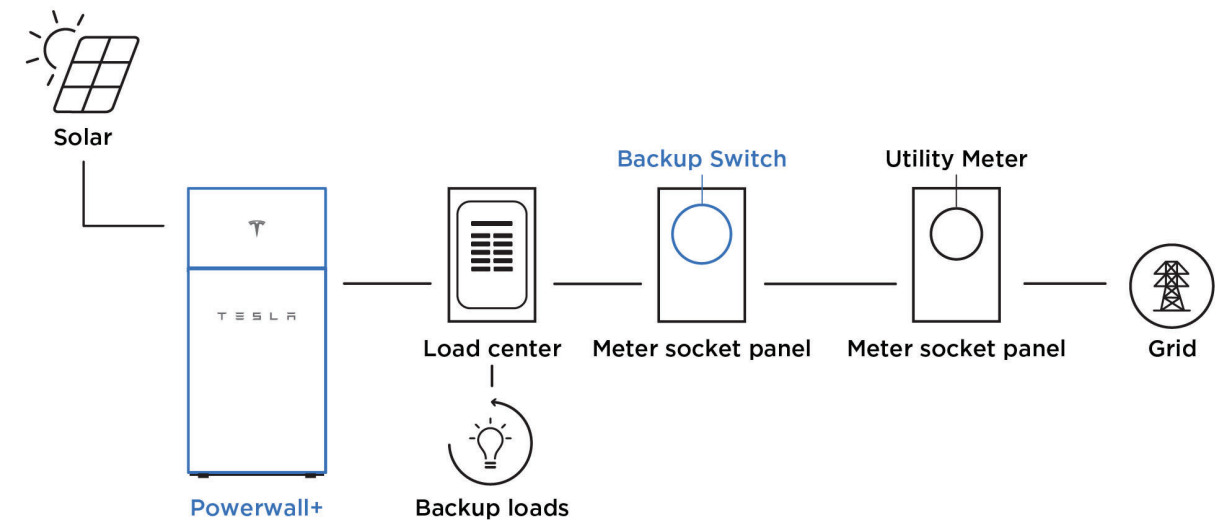
Exception: Tesla solar modules installed in locations where the max Voc for three modules at low design temperatures exceeds 165 V shall be limited to two modules between Solar Shutdown Devices.

SYSTEM LAYOUTS

Powerwall+ with Backup Switch Installed Behind Utility Meter



Powerwall+ with Backup Switch Installed Downstream of Utility Meter



Tesla Photovoltaic Module

T395H, T400H, and T405H

The Tesla module is one of the most powerful residential photovoltaic modules available and exceeds industry engineering and quality standards. Featuring our proprietary Zep Groove design, the all-black module mounts close to your roof for a minimalist aesthetic. Modules are certified to IEC / UL 61730 - 1, IEC / UL 61730 - 2 and IEC 61215.



REVIEWED

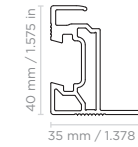
By Winnie Cargill at 2:09 pm, Jan 23, 2023



Module Specifications

Electrical Characteristics

Power Class	T395H		T400H		T405H	
	STC	NMOT	STC	NMOT	STC	NMOT
Test Method	STC	NMOT	STC	NMOT	STC	NMOT
Max Power, P _{MAX} (W)	395	296.3	400	300.1	405	303.8
Open Circuit Voltage, V _{OC} (V)	45.27	42.69	45.30	42.72	45.34	42.76
Short Circuit Current, I _{SC} (A)	11.10	8.95	11.14	8.97	11.17	9.00
Max Power Voltage, V _{MP} (V)	36.88	35.03	37.13	35.25	37.39	35.46
Max Power Current, I _{MP} (A)	10.71	8.46	10.77	8.51	10.83	8.57
Module Efficiency (%)	≥ 20.1		≥ 20.4		≥ 20.6	
STC	1000 W/m ² , 25°C, AM1.5					
NOCT	800 W/m ² , 20°C, AM1.5, wind speed 1 m/s					



Mechanical Loading

Front Side Test Load	6120 Pa 128 lb/ft ²	Refer to module and system installation manuals for allowable design loads, foot spacings, and cantilever specifications.
Rear Side Test Load	6120 Pa 128 lb/ft ²	
Front Side Design Load	4080 Pa 85 lb/ft ²	
Rear Side Design Load	4080 Pa 85 lb/ft ²	
Hail Test	35 mm at 27.2 m/s	

Mechanical Parameters

Cell Orientation	132 (6 x 22)
Junction Box	IP68, 3 diodes
Cable	4 mm ² 12 AWG, 1325 mm 47.2 in. Length
Connector	Staubli MC4
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass
Frame	Black Anodized Aluminum Alloy
Weight	23.5 kg 51.8 lb
Dimension	1890 mm x 1046 mm x 40 mm 74.4 in x 41.2 in x 1.57 in

Operation Parameters

Operational Temperature	-40°C up to +85°C
Power Output Tolerance	-0 / +5 W
V _{OC} & I _{SC} Tolerance	+/- 5%
Max System Voltage	DC 1000 V (IEC/UL)
Max Series Fuse Rating	20 A
NOCT	45.7 +/- 3 °C
Safety Class	Class II
Fire Rating	UL 61730 Type 2

Linear Power Warranty

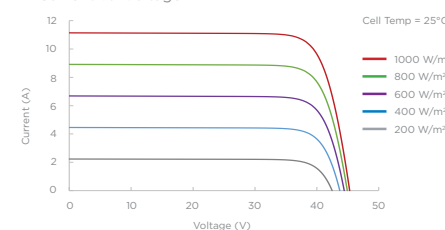
Materials and Processing	25 years
Extra Linear Power Output	25 years

At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

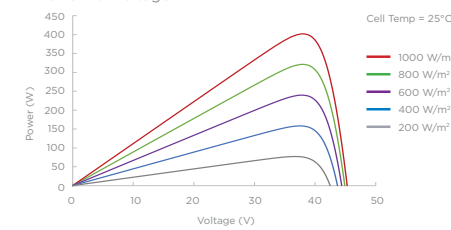


IV Curves

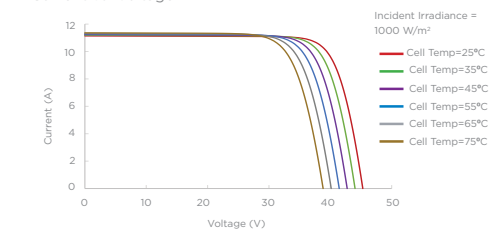
Current vs. Voltage



Power vs. Voltage



Current vs. Voltage



Wire & Conduit Size Equivalence Table: Copper & Aluminum

Rating (A)	Copper			Aluminum	
	Conductor (AWG or kcmil)	Min. EGC (AWG)	Conduit	Conductor (AWG or kcmil)	Conduit
100	3	8	1" - EMT	1	1-1/4" - EMT
115	2	6	1-1/4" - EMT	1/0	2" - PVC
130	1	6	1-1/4" - EMT	2/0	2" - PVC
150	1/0	6	2" - PVC	3/0	2" - PVC
175	2/0	6	2" - PVC	4/0	2" - PVC
200	3/0	6	2" - PVC	250	2" - PVC

NEC Code references

NEC Table 310.15(B)(16) (formerly Table 310.16)

NEC Table 250.122

Table 310.104(A)

PV HAZARD CONTROL SYSTEM | ZS PVHCS

UL 3741 REPORT DATE 10-20-21 (APPLICABLE TO ZS COMP, ZS SPAN, ZS RAMP, AND ZS SEAM)
PV RAPID SHUTDOWN ARRAY, UL 1741 CATEGORY QIJR

WARNING: To reduce the risk of injury, read all instructions.

PV HAZARD CONTROL EQUIPMENT AND COMPONENTS

Function	Manufacturer	Model No.	Firmware Versions and Checksums	Certification Standard
PVRSE Mid Circuit Interrupter (MCI)	Tesla	MCI-1	N/A	UL 1741 PVRSE
Inverter or Powerwall+	Tesla	7.6 kW: 1538000 ¹ 3.8 kW: 1534000 ¹ 7.6 kW: 1850000 ¹	V4, CEA4F802 V4, FF7BE4E1 V4, CEA4F802	UL 1741, 1998 PVRSS/PVRSE
PV Module	Hanwha/ Q-CELLS Tesla	Q.PEAK DUO BLK-G5/SC310-320 Q.PEAK DUO BLK G6+/SC330-345 Tesla TxxxS (xxx = 405 to 450) Tesla TxxxH (xxx = 395 to 415)	N/A	UL 1703 UL 61730
PVHCS Initiator (PV Inverter)	Dedicated PV system AC circuit breaker or AC disconnect switch, labeled per NEC 690.12 requirements.			N/A
PVHCS Initiator (Powerwall+)	Emergency stop device (NISD)- Listed "Emergency Stop Button" or "Emergency Stop Device" or "Emergency Stop Unit".			UL 508 or UL 60947 Parts 1, 5-1 and 5-5

¹ Applies to variations of this part number with suffix of two numbers and one letter.

Note: PVHCS installation requirements may reduce the effective equipment and component ratings below the individual equipment and component PVRSE ratings in order to achieve PVHCS shock hazard reduction requirements.

PVHCS INSTALLATION REQUIREMENTS

Max System Voltage	600 Vdc
PVHCS Maximum Circuit Voltage (Array Internal Voltage After Actuation)	165 Vdc (cold weather open circuit)
Max Series-Connected Modules Between MCIs: *Exception: Tesla S-Series (TxxxS) modules installed in locations where the max VOC for 3 modules at low design temperature exceeds 165V shall be limited to 2 modules between MCIs.	3*

OTHER INSTALLATION INSTRUCTIONS

1. An MCI must be connected to one end of each series string or mounting plane sub-array string.
2. Verification that MCIs are installed with 3 or fewer modules between MCIs shall be documented for inspection, by voltage measurement logs and/or as-built string layout diagrams.
3. For PV Inverter: The PVHCS initiator (AC breaker or switch) shall be sized and installed in accordance with NEC requirements. The specific part shall be identified on the as-built system drawings.
4. For Powerwall+: The PVHCS emergency stop initiator shall have the following minimum ratings: Outdoor (Type 3R or higher), 12V, 1A, and shall be installed in accordance with NEC requirements. The specific part shall be identified on the as-built system drawings. Refer to the Powerwall+ installation manual for further details.



Certification Mark of UL on the installation instructions is the only method provided by UL to identify products manufactured under its Certification and Follow-Up Service. The Certification Mark for these products includes the UL symbol, the words "CERTIFIED" and "SAFETY," the geographic identifier(s), and a file number.

PV HAZARD CONTROL SYSTEM PVHCS | CERTIFICATION

UL 3741 REPORT DATE 8-12-21
PV RAPID SHUTDOWN ARRAY, UL 1741 CATEGORY QIJR, REPORT DATE: 2021-06-11 (REV 8-10-21)

WARNING: To reduce the risk of injury, read all instructions.

PV HAZARD CONTROL EQUIPMENT AND COMPONENTS

Function	Manufacturer	Model No.	Firmware Versions and Checksums	Certification Standard
PVRSE Mid Circuit Interrupter (MCI)	Tesla	MCI-1 1550379 ¹	N/A	UL 1741 PVRSE
Inverter or Powerwall+	Tesla	7.6 kW: 1538000 ¹ 3.8 kW: 1534000 ¹ 7.6 kW: 1850000 ¹	V4, CEA4F802 V4, FF7BE4E1 V4, CEA4F802	UL 1741, 1998 PVRSS/PVRSE
PV Module	Tesla	SR60T1, SR72T1 SR72T2	N/A	UL 61730
Diode Harness (Not applicable to SR72T2)	Tesla	SRDTH	N/A	UL 9703
PV Wire Jumper(s)	Tesla	SR-BJ2X, SR-BJ3X, SR-BJ4X, SR-BJMini	N/A	UL 9703
Pass-Through Box	Tesla	SRPTB-4	N/A	UL 1741
PVHCS Initiator : (PV Inverter)	Dedicated PV system AC circuit breaker or AC disconnect switch, labeled per NEC 690.12 requirements.			N/A
PVHCS Initiator : (Powerwall+)	Emergency stop device (NISD)- Listed "Emergency Stop Button" or "Emergency Stop Device" or "Emergency Stop Unit"			UL 508 or UL 60947 Parts 1, 5-1 and 5-5

¹ Applies to variations of this part number with suffix of two numbers and one letter.

Note: PVHCS installation requirements may reduce the effective equipment and component ratings below the individual equipment and component PVRSE ratings in order to achieve PVHCS shock hazard reduction requirements.

PVHCS INSTALLATION REQUIREMENTS

Max System Voltage	600 Vdc
PVHCS Maximum Circuit Voltage (Array Internal Voltage After Actuation)	165 Vdc (cold weather open circuit)
Max Series-Connected Panels between MCIs	10

OTHER INSTALLATION INSTRUCTIONS

1. An MCI must be connected to one end of each series string or mounting plane sub-array string.
2. Verification that MCIs are installed with 10 or fewer modules between MCIs shall be documented for inspection, by voltage measurement logs and/or as-built string layout diagrams.
3. For PV Inverter: The PVHCS initiator (AC breaker or switch) shall be sized and installed in accordance with NEC requirements. The specific part shall be identified on the as-built system drawings.
4. For Powerwall+: The PVHCS emergency stop initiator shall have the following minimum ratings: Outdoor (Type 3R or higher), 12V, 1A, and shall be installed in accordance with NEC requirements. The specific part shall be identified on the as-built system drawings. Refer to the Powerwall+ installation manual for further details.



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