HISTORIC PRESERVATION COMMISSION

Marc Elrich
County Executive

Robert K. Sutton
Chairman

Date: January 19, 2023

MEMORANDUM

TO: Mitra Pedoeem
Department of Permitting Services
FROM: Dan Bruechert
Historic Preservation Section
Maryland-National Capital Park & Planning Commission
SUBJECT: Historic Area Work Permit #1014103 - Solar Installation

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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: Brendan Brammer
Address: 26001 Frederick Rd., Clarksburg

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 Dan Bruechert at 301.563.3400 or dan.bruechert@montgomeryplanning.org to schedule a follow-up site visit.

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, RAINTIGHT

ELECTRICAL NOTES

1. THIS SYSTEM IS GRID-INTERTIED VIA A UL-LISTED POWER-CONDITIONING INVERTER.
2. THIS SYSTEM HAS NO BATTERIES, NO UPS.
3. A NATIONALLY-RECOGNIZED TESTING LABORATORY SHALL LIST ALL EQUIPMENT IN COMPLIANCE WITH ART. 110.3.
4. 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.
5. EACH UNGROUNDED CONDUCTOR OF THE MULTIWIRE BRANCH CIRCUIT WILL BE IDENTIFIED BY PHASE AND SYSTEM PER ART. 210.5.
6. CIRCUITS OVER 250V TO GROUND SHALL COMPLY WITH ART. 250.97, 250.92(B).
7. 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).
8. ALL WIRES SHALL BE PROVIDED WITH STRAIN RELIEF AT ALL ENTRY INTO BOXES AS REQUIRED BY UL LISTING.
9. MODULE FRAMES SHALL BE GROUNDED AT THE UL-LISTED LOCATION PROVIDED BY THE MANUFACTURER USING UL LISTED GROUNDING HARDWARE.
10. 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.

APPROVED
Montgomery County
Historic Preservation Commission

REVIEWED
By Dan.Bruechert at 1:59 pm, Jan 19, 2023

LICENSE

#11805 MASTER ELECTRICIAN
Nicholaus Meyers

MODULE GROUNDING METHOD: ZEP SOLAR

AHJ: Montgomery County

UTILITY: Potomac Edison (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

REV	BY	DATE	COMMENTS
REV A	NAME	DATE	COMMENTS
*	*	*	*
*	*	*	*
*	*	*	*
*	*	*	*

JOB NUMBER: JB-20812111 00
MOUNTING SYSTEM: ZS Comp V4 w Flashing-Insert
MODULES: (25) Tesla # T400H
INVERTER: 7.6 kW Tesla Inc 1538000-00-F (240V)

CUSTOMER:
Brendan Barmmer
26001 Frederick Rd
Clarksburg, MD 20871

5713528652

DESCRIPTION: 10 KW PV ARRAY

PAGE NAME: COVER SHEET

DESIGN: Blake Parkison

SHEET: 1 REV: A DATE: 11/8/2022

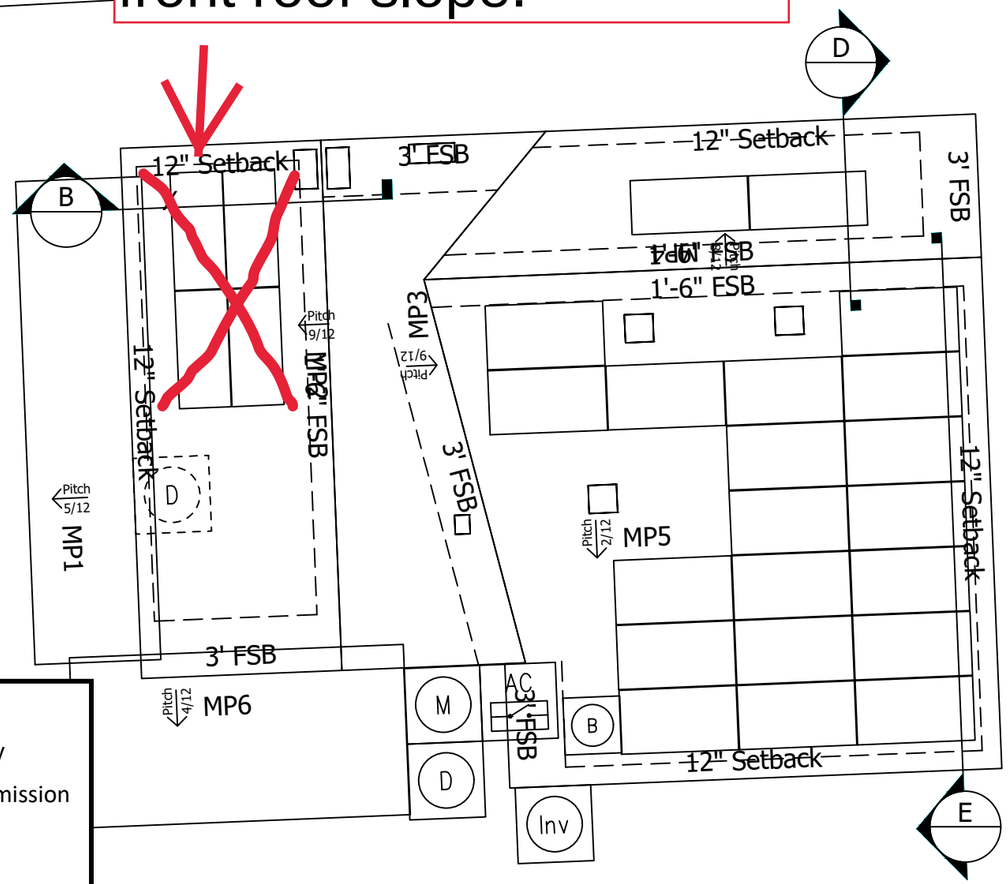
TESLA

House has a sprinkler system: NO

26001 Frederick Rd

(E) DRIVEWAY

The approval does not extend to 4 panels on the front roof slope.



Front Of House

APPROVED

Montgomery County

Historic Preservation Commission

REVIEWED

By Dan.Bruechert at 1:59 pm, Jan 19, 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. 49463, EXPIRATION DATE: 5-26-2024

STATE OF MARYLAND · JAMES H. CHILDS · No. 49463 · PROFESSIONAL ENGINEER

FOR STRUCTURAL ONLY

MP2	PITCH: 37° (9:12) ARRAY PITCH: 37° (9:12) AZIMUTH: 268 ARRAY AZIMUTH: 268 MATERIAL: Comp Shingle STORY: 2 Stories
MP4	PITCH: 34° (8:12) ARRAY PITCH: 34° (8:12) AZIMUTH: 358 ARRAY AZIMUTH: 358 MATERIAL: Comp Shingle STORY: 2 Stories
MP5	PITCH: 9° (2:12) ARRAY PITCH: 9° (2:12) AZIMUTH: 178 ARRAY AZIMUTH: 178 MATERIAL: Comp Shingle STORY: 2 Stories

LEGEND

- (M) (E) UTILITY METER & WARNING LABEL
- (Inv) INVERTER W/ INTEGRATED DC DISCO & WARNING LABELS
- (DC) DC DISCONNECT & WARNING LABELS
- (AC) AC DISCONNECT & WARNING LABELS
- (B) DC JUNCTION/COMBINER BOX & LABELS
- (D) DISTRIBUTION PANEL & LABELS
- (LC) LOAD CENTER & WARNING LABELS
- (M) DEDICATED PV SYSTEM METER
- (RSD) RAPID SHUTDOWN
- STANDOFF LOCATIONS
- CONDUIT RUN ON EXTERIOR
- CONDUIT RUN ON INTERIOR
- GATE/FENCE
- HEAT PRODUCING VENTS ARE RED
- INTERIOR EQUIPMENT IS DASHED

TOTAL ARRAY AREA (SF): 542
TOTAL ROOF AREA (SF): 1965
TOTAL ARRAY AREA IS ≈ 27.59 PERCENT OF TOTAL ROOF AREA

SITE PLAN

Scale: 1/8" = 1'

0 1' 8' 16'

N W E S

JOB NUMBER: JB–20812111 00

MOUNTING SYSTEM: ZS Comp V4 w Flashing–Insert

MODULES: (25) Tesla # T400H

INVERTER: 7.6 kW Tesla Inc 1538000–00–F (240V)

CUSTOMER:
Brendan Barmmer
26001 Frederick Rd
Clarksburg, MD 20871

5713528652

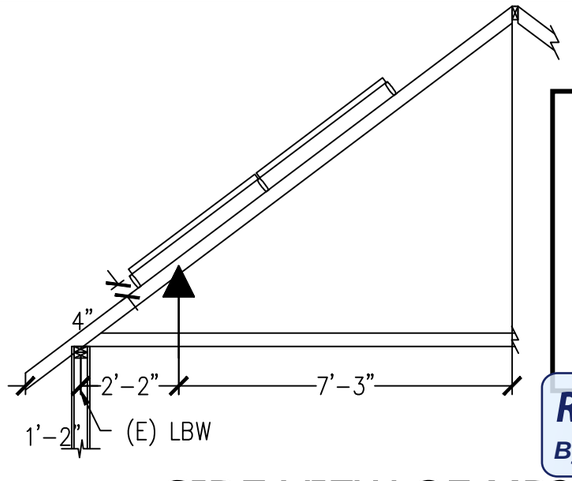
DESCRIPTION: 10 KW PV ARRAY

PAGE NAME: SITE PLAN

DESIGN: Blake Parkison

SHEET: 2 REV: A DATE: 11/8/2022

TESLA



APPROVED

Montgomery County

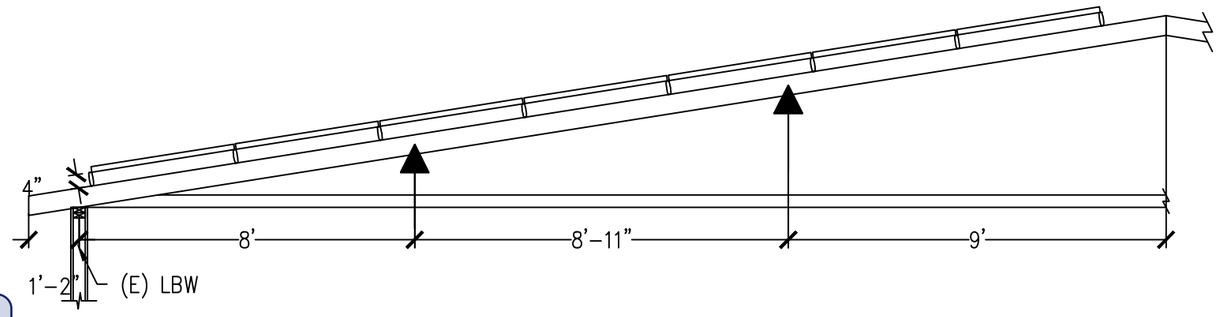
Historic Preservation Commission

REVIEWED

By Dan.Bruechert at 1:59 pm, Jan 19, 2023

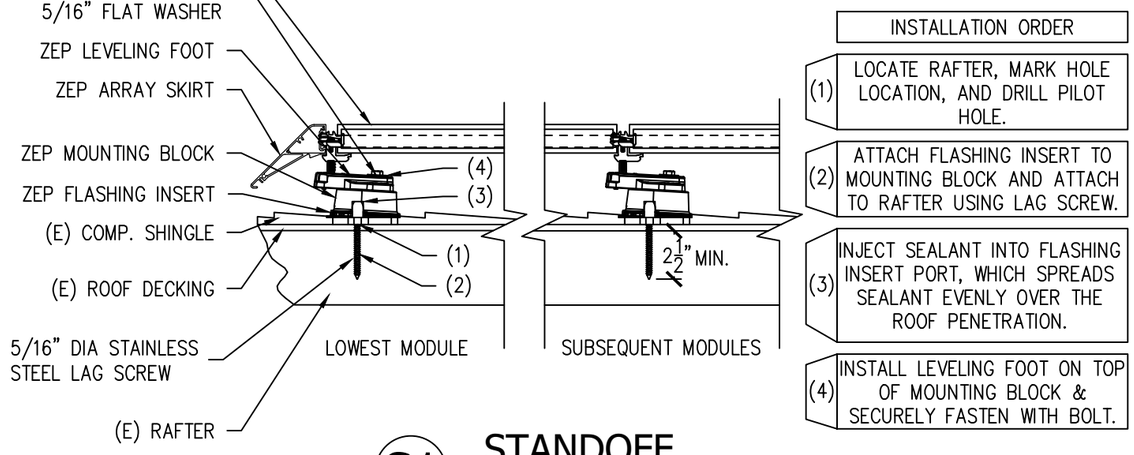
B SIDE VIEW OF MP2 NTS

MP2				
RAFTER	3"x3-1/2" @ 24" OC	ROOF AZI 268 PITCH 37 ARRAY AZI 268 PITCH 37	STORIES: 2
C.J.	1-1/2"x3-1/2" @24" OC	Comp Shingle	



E SIDE VIEW OF MP5 NTS

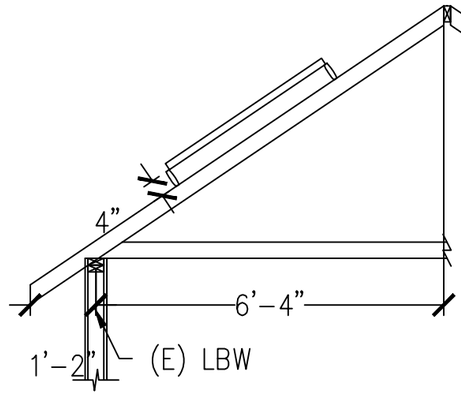
MP5				
RAFTER	2x6 @ 16" OC	ROOF AZI 178 PITCH 9 ARRAY AZI 178 PITCH 9	STORIES: 2
C.J.	2x4 @24" OC	Comp Shingle	



INSTALLATION ORDER	
(1)	LOCATE RAFTER, MARK HOLE LOCATION, AND DRILL PILOT HOLE.
(2)	ATTACH FLASHING INSERT TO MOUNTING BLOCK AND ATTACH TO RAFTER USING LAG SCREW.
(3)	INJECT SEALANT INTO FLASHING INSERT PORT, WHICH SPREADS SEALANT EVENLY OVER THE ROOF PENETRATION.
(4)	INSTALL LEVELING FOOT ON TOP OF MOUNTING BLOCK & SECURELY FASTEN WITH BOLT.

S1 STANDOFF

Scale: 1 1/2" = 1'



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LICENSE NO. 49463, EXPIRATION DATE: 5-26-2024

D SIDE VIEW OF MP4 NTS

MP4				
RAFTER	3"x3-1/2" @ 24" OC	ROOF AZI 358 PITCH 34 ARRAY AZI 358 PITCH 34	STORIES: 2
C.J.	1-1/2"x3-1/2" @24" OC	Comp Shingle	

JOB NUMBER: JB–20812111 00

MOUNTING SYSTEM: ZS Comp V4 w Flashing–Insert

MODULES: (25) Tesla # T400H

INVERTER: 7.6 kW Tesla Inc 1538000–00–F (240V)

CUSTOMER:
Brendan Barmmer
26001 Frederick Rd
Clarksburg, MD 20871

5713528652

DESCRIPTION: 10 KW PV ARRAY

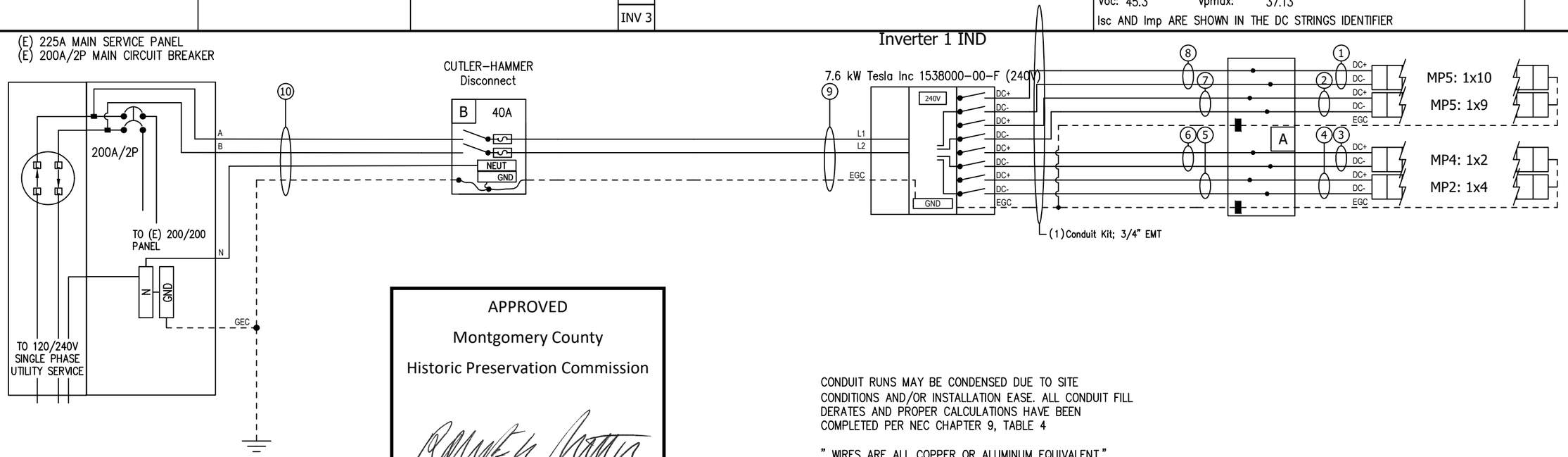
PAGE NAME: STRUCTURAL VIEWS

DESIGN: Blake Parkison

SHEET: 3 REV: DATE: 9/22/2022

TESLA

MAIN PANEL SPECS	GENERAL NOTES	INVERTER SPECS	MODULE SPECS	LICENSE
Panel Number: NoLabel Meter Number: S335527955 Underground Service Entrance	Inv 1: DC Ungrounded Tie-In: Supply Side Connection	INV 1 – (1) 7.6 kW Tesla Inc 1538000-00-F (240V) INV 2 INV 3	– (25) Tesla # T400H PV Module, 400W, 371.5 PTC, 40MM, Black Frame, MC4/MC4-EVO2, ZEP, 1000V Voc: 45.3 Vpmax: 37.13 Isc AND Imp ARE SHOWN IN THE DC STRINGS IDENTIFIER	#11805 MASTER ELECTRICIAN Nicholaus Meyers



APPROVED

Montgomery County

Historic Preservation Commission

REVIEWED

By Dan.Bruechert at 2:02 pm, Jan 19, 2023

CONDUIT RUNS MAY BE CONDENSED DUE TO SITE CONDITIONS AND/OR INSTALLATION EASE. ALL CONDUIT FILL DERATES AND PROPER CALCULATIONS HAVE BEEN COMPLETED PER NEC CHAPTER 9, TABLE 4

" WIRES ARE ALL COPPER OR ALUMINUM EQUIVALENT."

CONDUCTORS RATED TO 100A OR GREATER MAY BE INSTALLED WITH ALUMINUM RATED EQUIVALENT WIRE SIZE AND THE RESULTING CONDUIT SIZE. REFERENCE THE 'WIRE & CONDUIT SIZE EQUIVALENCE TABLE' ATTACHED TO THE PLANSET.

Voc* = MAX VOC AT MIN TEMP

GD — Please see MCI wiring detail page for more information

AC

POI — (2) ILSCO # IPC 4/0-#6
Insulation Piercing Connector; Main 4/0-4, Tap 6-14

SSC — SUPPLY SIDE CONNECTION. DISCONNECTING MEANS SHALL BE SUITABLE AS SERVICE EQUIPMENT AND SHALL BE RATED PER NEC.

B
- (1) CUTLER-HAMMER # DG222NRB
  Disconnect; 60A, 240Vac, Fusible, NEMA 3R
- (1) CUTLER-HAMMER # DG100NB
  Ground/Neutral Kit; 60-100A, General Duty (DG)
- (1) CUTLER-HAMMER #DS16FK
  Class R Fuse Kit
- (2) FERRAZ SHAWMUT # TR40R PV BACKFEED OCP
  Fuse; 40A, 250V, Class RK5

C
- (1) SQUARE D #HOM816L125PC
  Load Center;125A,Convertible,NEMA1,8sp/16cir,grnd bar,120v/240v,10kAIC,Combo cover
- (1) SQUARE D # HOM240
  Breaker; 40A/2P, 2 Spaces

DC

A
- (1) Tesla 4J 4-String Combiner Box
  UNFUSED, GROUNDED, Black, Diag DIN Rail with Bracket/ Cord Grip

PV
- (10) Tesla MCI, 650V, 12A

10	5ft	(1) AWG #6, THWN-2, Black (1) AWG #6, THWN-2, Red (1) AWG #6, Solid Bare Copper GEC (1) Conduit Kit; 3/4" EMT	Vmp = 240 VAC	Imp = 32 AAC
9	10ft	(1) AWG #8, THWN-2, Black (1) AWG #8, THWN-2, Red (1) AWG #10, THWN-2, Green EGC (1) Conduit Kit; 3/4" EMT	Vmp = 240 VAC	Imp = 32 AAC
5	50ft	(1) AWG #10, THWN-2, Black (1) AWG #10, THWN-2, Red (1) AWG #6, THWN-2, Green EGC – (1) Conduit Kit; 3/4" EMT	Voc* = 205.66 VDC Vmp = 148.52 VDC	Isc = 11.14 ADC Imp = 10.77 ADC
6	50ft	(1) AWG #10, THWN-2, Black (1) AWG #10, THWN-2, Red (1) AWG #6, THWN-2, Green EGC – (1) Conduit Kit; 3/4" EMT	Voc* = 102.83 VDC Vmp = 74.26 VDC	Isc = 11.14 ADC Imp = 10.77 ADC
7	50ft	(1) AWG #10, THWN-2, Black (1) AWG #10, THWN-2, Red (1) AWG #6, THWN-2, Green EGC – (1) Conduit Kit; 3/4" EMT	Voc* = 462.74 VDC Vmp = 334.17 VDC	Isc = 11.14 ADC Imp = 10.77 ADC
8	50ft	(1) AWG #10, THWN-2, Black (1) AWG #10, THWN-2, Red (1) AWG #6, THWN-2, Green EGC – (1) Conduit Kit; 3/4" EMT	Voc* = 514.16 VDC Vmp = 371.3 VDC	Isc = 11.14 ADC Imp = 10.77 ADC
1	25ft	(2) PV Wire, AWG 10 (1) AWG #10, Solid Bare Copper EGC	Voc* = 514.16 VDC Vmp = 371.3 VDC	Isc = 11.14 ADC Imp = 10.77 ADC
2	25ft	(2) PV Wire, AWG 10 (1) AWG #10, Solid Bare Copper EGC	Voc* = 462.74 VDC Vmp = 334.17 VDC	Isc = 11.14 ADC Imp = 10.77 ADC
3	5ft	(2) PV Wire, AWG 10 (1) AWG #10, Solid Bare Copper EGC	Voc* = 102.83 VDC Vmp = 74.26 VDC	Isc = 11.14 ADC Imp = 10.77 ADC
4	10ft	(2) PV Wire, AWG 10 (1) AWG #10, Solid Bare Copper EGC	Voc* = 205.66 VDC Vmp = 148.52 VDC	Isc = 11.14 ADC Imp = 10.77 ADC

JOB NUMBER: JB-20812111 00

MOUNTING SYSTEM: ZS Comp V4 w Flashing-Insert

MODULES: (25) Tesla # T400H

INVERTER: 7.6 kW Tesla Inc 1538000-00-F (240V)

CUSTOMER:
Brendan Barmmer
26001 Frederick Rd
Clarksburg, MD 20871

5713528652

DESCRIPTION: 10 KW PV ARRAY

PAGE NAME: THREE LINE DIAGRAM

DESIGN: Blake Parkison

SHEET: 5 REV: A DATE: 11/8/2022

TESLA

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

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

WARNING

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

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

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

PHOTOVOLTAIC AC DISCONNECT

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

MAXIMUM AC OPERATING CURRENT ____ A
MAXIMUM AC OPERATING VOLTAGE ____ V

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

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

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

CAUTION

PHOTOVOLTAIC SYSTEM
CIRCUIT IS BACKFED

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

CAUTION

DUAL POWER SOURCE
SECOND SOURCE IS
PHOTOVOLTAIC SYSTEM

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

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
MAXIMUM AC OPERATING CURRENT ____ A
MAXIMUM AC OPERATING VOLTAGE ____ V

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

WARNING

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

Label Location:
(DC) (INV)

APPROVED

Montgomery County

Historic Preservation Commission

REVIEWED
By Dan.Bruechert at 2:02 pm, Jan 19, 2023

(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

Label Set

MCI WIRING DETAIL

GENERAL NOTES

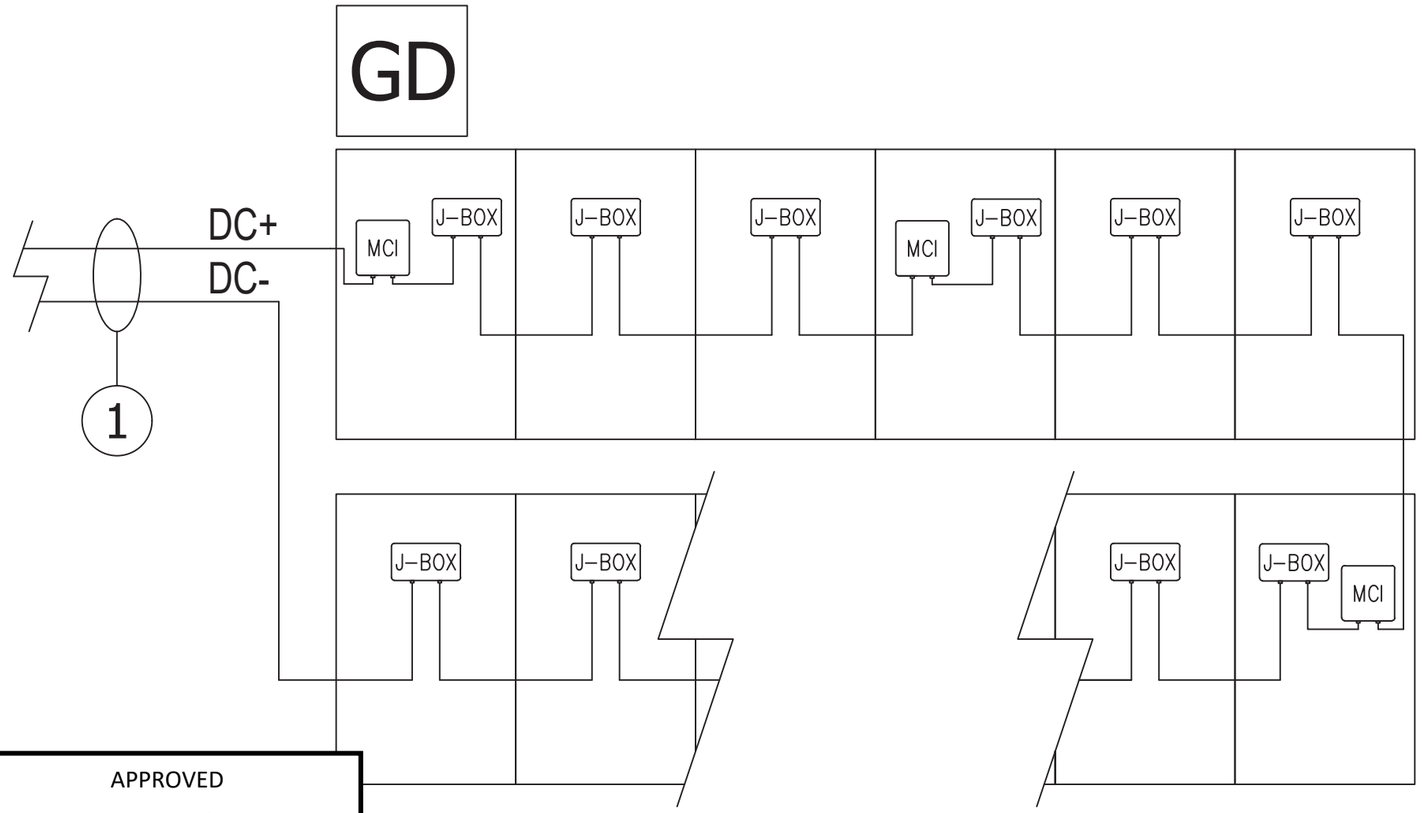
- DRAWING OF STANDARD MCI WIRING DETAIL FOR ANY GIVEN STRING LENGTH
- IF INITIATED, RAPID SHUTDOWN OCCURS WITHIN 30 SECONDS OF ACTIVATION AND LIMITS VOLTAGE ON THE ROOF TO NO GREATER THAN 165V (690.12.B.2.1)
- MID CIRCUIT INTERRUPTER (MCI) IS A UL 1741 PVRSE CERTIFIED RAPID SHUTDOWN DEVICE (RSD)

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



APPROVED
Montgomery County
Historic Preservation Commission

REVIEWED
By Dan.Bruechert at 2:03 pm, Jan 19, 2023

1 — (2) AWG, PV Wire, 600V, Black

DC

APPROVED

Montgomery County

Historic Preservation Commission

1 Tesla Road, Austin, TX 78725
P 650 681 5100 F 650 681 5101

Version #95.5 - 3
PIL

November 3, 2022

REVIEWED
By Dan.Bruechert at 1:59 pm, Jan 19, 2023

cation Letter
Project/Job # 20812111

Project Address:	Barmmer Residence 26001 Frederick Rd Clarksburg, MD 20871
AHJ	Montgomery County
SC Office	Beltsville

Design Criteria:
- Total Number of Modules = 25
- Applicable Codes = 2018 IEBC/IBC, 2018 IRC, 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
- MP2: 2x4 Stick Frame @ 24" OC, Comp Roof, Roof DL = 9 psf, Roof LL/SL = 20.8 psf (Non-PV), Roof LL/SL = 11.5 psf (PV)
- MP4: 2x4 Stick Frame @ 24" OC, Comp Roof, Roof DL = 9 psf, Roof LL/SL = 20.8 psf (Non-PV), Roof LL/SL = 12.5 psf (PV)
- MP5: 2x6 Stick Frame @ 16" OC, Comp Roof, Roof DL = 10 psf, Roof LL/SL = 20.8 psf (Non-PV), Roof LL/SL = 20.8 psf (PV)

Note: Per IBC 1613.1; Seismic check is not required because Ss = 0.135 < 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.

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. 49463, EXPIRATION DATE: 5-26-2024

1 Tesla Road, Austin, TX 78725
P 650 681 5100 F 650 681 5101

Version #95.5 - 3
PIL

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
MP2	72"	24"	41"	NA	Staggered	68.6%
MP4	72"	24"	41"	NA	Staggered	68.4%
MP5	64"	24"	41"	NA	Staggered	80.9%

Portrait Hardware	Hardware - Portrait Modules' Standoff Specifications					
	X-X Spacing	X-X Cantilever	Y-Y Spacing	Y-Y Cantilever	Configuration	Uplift DCR
MP2	48"	19"	74"	NA	Staggered	82.6%
MP4	48"	19"	74"	NA	Staggered	82.3%
MP5	32"	15"	74"	NA	Staggered	73.1%

Mounting Plane	Structure Information			Qualification Results
	Type	Pitch	Spacing	Member Evaluation Results
MP2	Stick Frame	37°	24" O.C.	Member Impact Check OK
MP4	Stick Frame	34°	24" O.C.	Member Impact Check OK
MP5	Stick Frame	9°	16" O.C.	Member Analysis OK

STRUCTURE ANALYSIS - LOADING SUMMARY AND MEMBER CHECK - MP2

Member Properties Summary					
MP2		**Horizontal Member Spans**		**Rafter Properties**	
		Overhang	1.20 ft	**Actual W**	1.50''
Roof System Properties		**Span 1**	2.13 ft	**Actual D**	3.50''
Number of Spans (w/o Overhang)	2	**Span 2**	7.24 ft	**Nominal**	Yes
Roofing Material	Comp Roof	**Span 3**		**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**	13.23 ft	**TL Defl'n Limit**	120
Vaulted Ceiling	No	**PV 1 Start**	0.50 ft	**Wood Species**	SPF
Ceiling Finish	1/2" Gypsum Board	**PV 1 End**	10.57 ft	**Wood Grade**	#2
Rafter Slope	37°	**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	**9/12**	**Initial**	**Pitch Adjust**	**Non-PV Areas**	**PV Areas**
Roof Dead Load	**DL**	9.0 psf	x 1.25	11.3 psf	11.3 psf
PV Dead Load	**PV-DL**	3.0 psf	x 1.25		3.8 psf
Roof Live Load	**RLL**	20.0 psf	x 0.75	15.0 psf	
Snow Load	**SL**[1,2]	30.0 psf	x 0.69 l x 0.38	20.8 psf	11.5 psf
Total Load (Governing LC)	**TL**			**32.1 psf**	**26.5 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	**32.1**		**26.5**	**-17%**	**Pass**

ZEP HARDWARE DESIGN CALCULATIONS - MP2

Mounting Plane Information			
Roofing Material		Comp Roof	
Roof Slope		37°	
Framing Type / Direction		Y-Y Rafters	
PV System Type		SolarCity SleekMount™	
Zep System Type		ZS Comp	
Standoff (Attachment Hardware)		ZS Comp V4 with Flashing Insert	
Spanning Vents		No	

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	Ke	1.00	Table 26.9-1
Velocity Pressure	**q_h**	**qh = 0.00256 (Kz) (Kzt) (Kd) (Ke) (V^2) 27.2 psf**	**Equation 26.10-1**

		Wind Pressure	
Ext. Pressure Coefficient (Up)	GCp (Up)	-1.47	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Ext. Pressure Coefficient (Down)	GCp (Down)	0.77	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Design Wind Pressure	p	p = qh (yE) (ya) (GCp); yE = 1.15, yA = 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) = 3.8 ft.; Effective Wind Area (A) = 21.3 sf

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

ALLOWABLE STANDOFF SPACINGS

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Landscape	72''	41''
Max Allowable Cantilever	Landscape	24''	NA
Standoff Configuration	Landscape	Staggered	
Max Standoff Tributary Area (Interior)	Trib	21 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-313 lbs	
Uplift Capacity of Standoff	T-allow	456 lbs	
Standoff Demand/Capacity (Interior)	DCR	68.6%	

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Portrait	48''	74''
Max Allowable Cantilever	Portrait	19''	NA
Standoff Configuration	Portrait	Staggered	
Max Standoff Tributary Area (Interior)	Trib	25 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-377 lbs	
Uplift Capacity of Standoff	T-allow	456 lbs	
Standoff Demand/Capacity (Interior)	DCR	82.6%	

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**	6.34 ft	**Actual D**	3.50''
Number of Spans (w/o Overhang)	1	**Span 2**		**Nominal**	Yes
Roofing Material	Comp Roof	**Span 3**		**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**	9.09 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**	5.67 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**	9.0 psf	x 1.21	10.9 psf	10.9 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 0.69 I x 0.42	20.8 psf	12.5 psf
Total Load (Governing LC)	**TL**			**31.7 psf**	**27.0 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	**31.7**		**27.0**	**-15%**	**Pass**

ZEP HARDWARE DESIGN CALCULATIONS - MP4

Mounting Plane Information			
Roofing Material		Comp Roof	
Roof Slope		34°	
Framing Type / Direction		Y-Y Rafters	
PV System Type		SolarCity SleekMount™	
Zep System Type		ZS Comp	
Standoff (Attachment Hardware)		ZS Comp V4 with Flashing Insert	
Spanning Vents		No	

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	Ke	1.00	Table 26.9-1
Velocity Pressure	**q_h**	**qh = 0.00256 (Kz) (Kzt) (Kd) (Ke) (V^2) 27.2 psf**	**Equation 26.10-1**

		Wind Pressure	
Ext. Pressure Coefficient (Up)	GCp (Up)	-1.47	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Ext. Pressure Coefficient (Down)	GCp (Down)	0.77	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Design Wind Pressure	p	p = qh (yE) (ya) (GCp); yE = 1.15, yA = 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) = 3.8 ft.; Effective Wind Area (A) = 21.3 sf

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

ALLOWABLE STANDOFF SPACINGS

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Landscape	72''	41''
Max Allowable Cantilever	Landscape	24''	NA
Standoff Configuration	Landscape	Staggered	
Max Standoff Tributary Area (Interior)	Trib	21 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-312 lbs	
Uplift Capacity of Standoff	T-allow	456 lbs	
Standoff Demand/Capacity (Interior)	DCR	68.4%	

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Portrait	48''	74''
Max Allowable Cantilever	Portrait	19''	NA
Standoff Configuration	Portrait	Staggered	
Max Standoff Tributary Area (Interior)	Trib	25 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-375 lbs	
Uplift Capacity of Standoff	T-allow	456 lbs	
Standoff Demand/Capacity (Interior)	DCR	82.3%	

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**	7.98 ft	**Actual D**	5.50''
Number of Spans (w/o Overhang)	3	**Span 2**	8.88 ft	**Nominal**	Yes
Roofing Material	Comp Roof	**Span 3**	8.98 ft	**A (in^2)**	8.25
Re-Roof	No	**Span 4**		**Sx (in.^3)**	7.56
Plywood Sheathing	Yes	**Span 5**		**Ix (in^4)**	20.80
Board Sheathing	None	**Total Rake Span**	27.37 ft	**TL Defl'n Limit**	120
Vaulted Ceiling	No	**PV 1 Start**	1.25 ft	**Wood Species**	SPF
Ceiling Finish	1/2" Gypsum Board	**PV 1 End**	25.33 ft	**Wood Grade**	#2
Rafter Slope	9°	**PV 2 Start**		**Fb (psi)**	875
Rafter Spacing	16" 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	**2/12**	**Initial**	**Pitch Adjust**	**Non-PV Areas**	**PV Areas**
Roof Dead Load	**DL**	10.0 psf	x 1.01	10.1 psf	10.1 psf
PV Dead Load	**PV-DL**	3.0 psf	x 1.01		3.0 psf
Roof Live Load	**RLL**	20.0 psf	x 1.00	20.0 psf	
Snow Load	**SL**[1,2]	30.0 psf	x 0.69 I x 0.69	20.8 psf	20.8 psf
Total Load (Governing LC)	**TL**			**30.9 psf**	**34.0 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**
(-) Bending Stress (psi)	**-595.7**	**18.0 ft**	**-1,202.6**	**50%**	**Pass**

ZEP HARDWARE DESIGN CALCULATIONS - MP5

Mounting Plane Information			
Roofing Material		Comp Roof	
Roof Slope		9°	
Framing Type / Direction		Y-Y Rafters	
PV System Type		SolarCity SleekMount™	
Zep System Type		ZS Comp	
Standoff (Attachment Hardware)		ZS Comp V4 with Flashing Insert	
Spanning Vents		No	

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	Ke	1.00	Table 26.9-1
Velocity Pressure	**q_h**	**qh = 0.00256 (Kz) (Kzt) (Kd) (Ke) (V^2) 27.2 psf**	**Equation 26.10-1**

		Wind Pressure	
Ext. Pressure Coefficient (Up)	GCp (Up)	-1.94	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Ext. Pressure Coefficient (Down)	GCp (Down)	0.46	Fig. 30.3-2A/B/C/D/E/G/H-5A/B
Design Wind Pressure	p	p = qh (yE) (ya) (GCp); yE = 1.15, yA = 0.60	Equation 29.4-7
Wind Pressure Up (Design | Ult)	**$p_{(up)}$**	**-21.9 | -36.6 psf**	
Wind Pressure Down (Design | Ult)	**$p_{(down)}$**	**9.6 | 16 psf**	

Notes: 1. Wind Zone Perimeter Width (a) = 3.8 ft.; Effective Wind Area (A) = 21.3 sf

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

ALLOWABLE STANDOFF SPACINGS

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Landscape	64''	41''
Max Allowable Cantilever	Landscape	24''	NA
Standoff Configuration	Landscape	Staggered	
Max Standoff Tributary Area (Interior)	Trib	18 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-369 lbs	
Uplift Capacity of Standoff	T-allow	456 lbs	
Standoff Demand/Capacity (Interior)	DCR	80.9%	

		X-Direction	Y-Direction
Max Allowable Standoff Spacing	Portrait	32''	74''
Max Allowable Cantilever	Portrait	15''	NA
Standoff Configuration	Portrait	Staggered	
Max Standoff Tributary Area (Interior)	Trib	17 sf	
PV Assembly Dead Load	W-PV	3.0 psf	
Net Wind Uplift at Standoff (Interior)	T-actual	-333 lbs	
Uplift Capacity of Standoff	T-allow	456 lbs	
Standoff Demand/Capacity (Interior)	DCR	73.1%	

Tesla Solar Inverter
with Solar Shutdown Device

—

Tesla Solar Inverter completes the Tesla home solar system, converting DC power from solar to AC power for home consumption. Tesla's renowned expertise in power electronics has been combined with robust safety features and a simple installation process to produce an outstanding solar inverter that is compatible with both Solar Roof and traditional solar panels. Once installed, homeowners use the Tesla mobile app to manage their solar system and monitor energy consumption, resulting in a truly unique ecosystem experience.

KEY FEATURES

- Built on Powerwall technology for exceptional efficiency and reliability
- Wi-Fi, Ethernet, and cellular connectivity with easy over-the-air updates
- Designed to integrate with Tesla Powerwall and Tesla App
- 0.5% revenue-grade metering for Solar Renewable Energy Credit (SREC) programs included
- 3.8 kW and 7.6 kW models available

Tesla Solar Inverter Technical Specifications

Electrical Specifications: Output (AC)

Model Number	**1534000-xx-y**	**1538000-xx-y**
Output (AC)	3.8 kW	7.6 kW
Nominal Power	3,800 W	7,600 W
Maximum Apparent Power	3,328 VA at 208 V 3,840 VA at 240 V	6,656 VA at 208 V 7,680 VA at 240 V
Maximum Continuous Current	16 A	32 A
Breaker (Overcurrent Protection)	20 A	40 A
Nominal Power Factor	1 - 0.9 (leading / lagging	
THD (at Nominal Power)	<5%	

Electrical Specifications: Input (DC)

MPPT	2	4
Input Connectors per MPPT	1-2	1-2-1-2
Maximum Input Voltage	600 VDC	
DC Input Voltage Range	60 - 550 VDC	
DC MPPT Voltage Range	60 - 480 VDC [1]	
Maximum Current per MPPT (I_{MP})	13 A [2]	
Maximum Short Circuit Current per MPPT (I_{SC})	17 A [2]	

[1] Maximum current.

[2] Where 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}.

Performance Specifications

Peak Efficiency	98% at 208 V 98.1% at 240 V	98.4% at 208 V 98.6% at 240 V
CEC Efficiency	97.5% at 208 V 97.5% at 240 V	97.5% at 208 V 98.0% at 240 V
Allowable DC/AC Ratio	1.7	
Customer Interface	Tesla Mobile App	
Internet Connectivity	Wi-Fi (2.4 GHz, 802.11 b/g/n), Ethernet [3], Cellular (LTE/4G) [4]	
Factory-Installed Revenue Grade Meter	Revenue Accurate (+/- 0.5%) [3]	
AC Remote Metering Support	Wi-Fi (2.4 GHz, 802.11 b/g/n), RS-485	
Protections	Integrated arc fault circuit interrupter (AFCI), Rapid Shutdown	
Supported Grid Types	60 Hz, 240 V Split Phase 60 Hz, 208 V Wye	

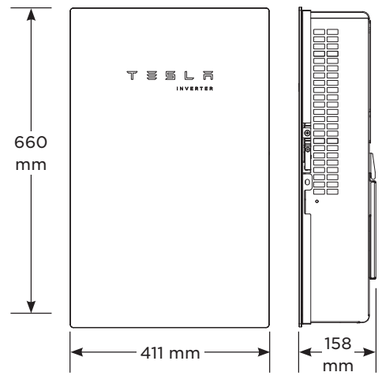
[3] Applicable to Tesla Solar Inverter with Site Controller (1538000-45-y) only.

[4] Cellular connectivity subject to network operator service coverage and signal strength.

Tesla Solar Inverter Technical Specifications

Mechanical Specifications

Dimensions	660 mm x 411 mm x 158 mm (26 in x 16 in x 6 in)



Weight	52 lb [5]
Mounting Options	Wall mount (bracket)

[5] Door and bracket can be removed for a mounting weight of 37 lb.

Environmental Specifications

Operating Temperature	–30°C to 45°C (–22°F to 113°F) [6]
Operating Humidity (RH)	Up to 100%, condensing
Storage Temperature	–30°C to 70°C (–22°F to 158°F)
Maximum Elevation	3000 m (9843 ft)
Environment	Indoor and outdoor rated
Enclosure Rating	Type 3R
Ingress Rating	IP55 (Wiring compartment)
Pollution Rating	PD2 for power electronics and terminal wiring compartment, PD3 for all other components
Operating Noise @ 1 m	< 40 db(A) nominal, < 50 db(A) maximum

[6] For the 7.6 kW Tesla Solar Inverter, performance may be de-rated to 6.2 kW at 240 V or 5.37 kW at 208 V when operating at temperatures greater than 45°C.

Compliance Information

Grid Certifications	UL 1741, UL 1741 SA, UL 1741 SB, IEEE 1547, IEEE 1547.1
Safety Certifications	UL 1741 PVRSS, UL 1699B, UL 1998 (US), UL 3741
Emissions	EN 61000-6-3 (Residential), FCC 47CFR15.109 (a)

Solar Shutdown Device 1 Technical Specifications

—

The 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 Tesla Solar Inverter, solar array shutdown is initiated by any loss of AC power.

Electrical Specifications

Nominal Input DC Current Rating (I_{MP})	12 A
Maximum Input Short Circuit Current (I_{SC})	15 A
Maximum System Voltage (PVHCS)	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

Environmental Specifications

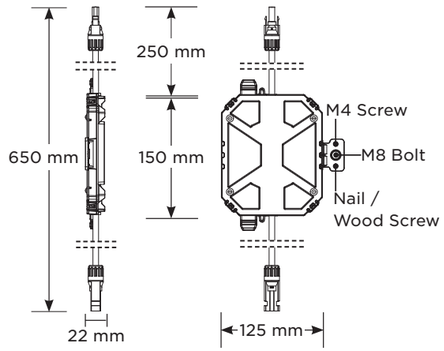
Ambient Temperature	-40°C to 50°C (-40°F to 122°F)
Storage Temperature	–30°C to 70°C (–22°F to 158°F)
Enclosure Rating	NEMA 4X / IP65

Compliance Information

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

Mechanical Specifications

Model Number	MCI-1
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 Tesla Solar Inverter and Solar Shutdown Devices. See Tesla Solar Inverter Rapid Shutdown: Module Selection Based on PV Hazard Control System Listing for guidance on installing Tesla Solar Inverter 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 [7]
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 or Q.PEAK DUO BLK-G6+	1 Solar Shutdown Device per 3 modules

[7] **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.

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.

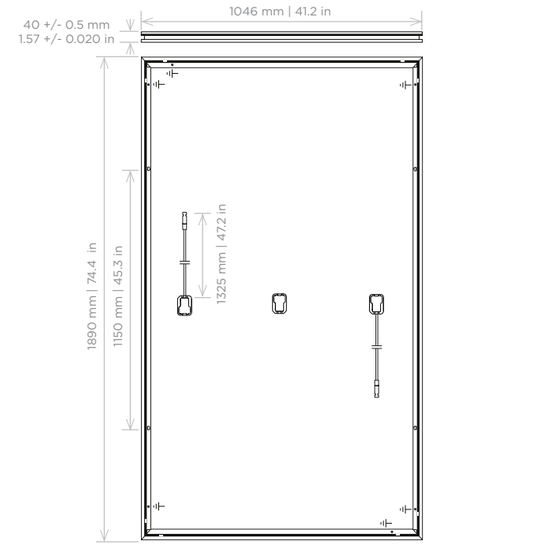
Module Specifications

Electrical Characteristics						
Power Class	T395H		T400H		T405H	
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/m², 25°C, AM1.5					
NOCT	800 W/m², 20°C, AM1.5, wind speed 1 m/s					

Mechanical Loading		
Front Side Test Load	6120 Pa | 128 lb/ ft²	Refer to module and system installation manuals for allowable design loads, foot spacings, and cantilever specifications.
Rear Side Test Load	6120 Pa | 128 lb/ ft²	
Front Side Design Load	4080 Pa | 85 lb/ft²	
Rear Side Design Load	4080 Pa | 85 lb/ft²	
Hail Test	35 mm at 27.2 m/s	

Temperature Rating (STC)	
Temperature Coefficient of Isc	+0.04% / °C
Temperature Coefficient of V_{OC}	-0.27% / °C
Temperature Coefficient of P_{MAX} (W)	-0.34% / °C

Mechanical Parameters	
Cell Orientation	132 (6 x 22)
Junction Box	IP68, 3 diodes
Cable	4 mm² | 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

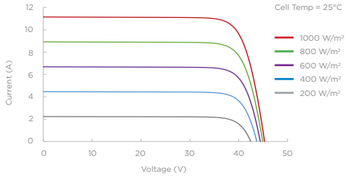
Linear Power Warranty

Materials and Processing	25 years
Extra Linear Power Output	25 years

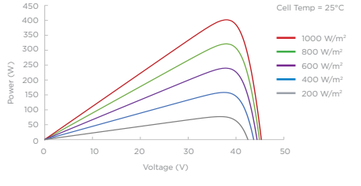
At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

IV Curves

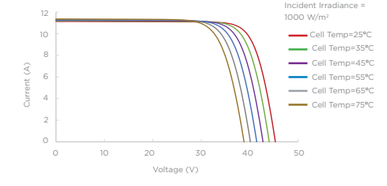
Current vs. Voltage



Power vs. Voltage



Current vs. Voltage



ROOFING SYSTEM SPECIFICATIONS

DESCRIPTION

PV mounting solution for composition shingle 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.

Engineered for spans up to 72” and cantilevers up to 24”.

ZS Comp has a UL 1703 Class “A” Fire Rating when installed using modules from any manufacturer certified as “Type 1” or “Type 2”.

Attachment method UL listed to UL 2582 for Wind Driven Rain.

ZS Comp supports 50 psf (2400 Pa) front and up to 72 psf (3450 Pa) rear side design load rating for Portrait module orientation per UL 2703.

ZS Comp supports 50 psf (2400 Pa) front side and up to 72 psf (3450 Pa) rear side design load rating for Landscape module orientation.

Engineered for compliance with ASCE 7-05, 7-10, and 7-16 wind load requirements.

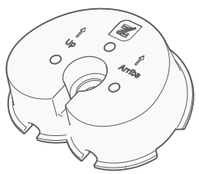
Zep wire management products listed to UL 1565 for wire positioning devices.

ZS Comp grounding products are listed to UL 2703 and UL 467.

ZS Comp bonding products are listed to UL 2703.

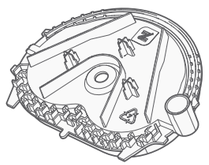
MOUNTING BLOCK

Listed to UL 2703
Part #850-1633



FLASHING INSERT

Listed to UL 2703 and UL 2582 for Wind Driven Rain
Part #850-1628



CAPTURED WASHER LAG

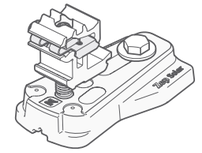
Part #850-1631-002 and #850-1631-004

GROUND ZEP

Listed to UL 2703
Part #850-1511

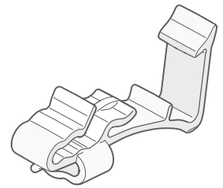
LEVELING FOOT

Listed to UL 2703
Part #850-1397



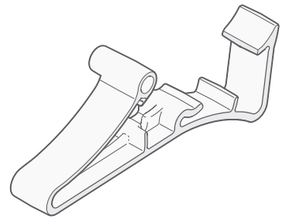
DC WIRE CLIP

Listed to UL 1565
Part #850-1509



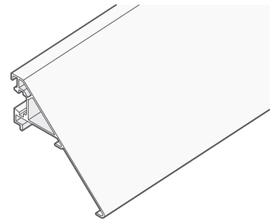
HOME RUN CLIP

Listed to UL 1565
Part #850-1510



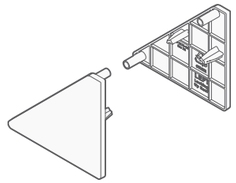
ARRAY SKIRT

Listed to UL 2703
Part #850-1608



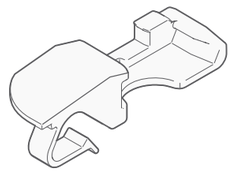
END CAP

Listed to UL 2703
Part #850-1586 (Left)
Part #850-1588 (Right)



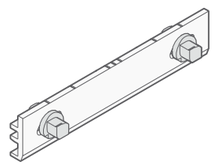
SKIRT GRIP

Listed to UL 2703
Part #850-1606



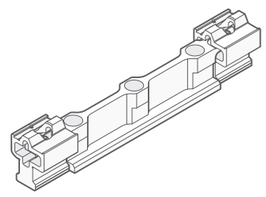
INTERLOCK

Listed to UL 2703
Part #850-1613



HYBRID INTERLOCK

Listed to UL 2703
Part #850-1281



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)

TESLA

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.

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.