

# PHOTOVOLTAIC SYSTEM

## PV SYSTEM SUMMARY: 12.325 KW

### RESIDENTIAL PHOTOVOLTAIC SYSTEM

SYSTEM SIZE (DC)	: STC: 29 X 425 = 12325W DC
	: PTC: 29 X 397 = 11513W DC
SYSTEM SIZE (AC)	: 10000W AC @ 240V
MODULES	: 29 X TESLA: T425S
OPTIMIZERS	: 29 X SOLAR EDGE: P505
INVERTER	: SOLAR EDGE: SE10000H-US [SI1]
TILT	: 40°, 40°
AZIMUTH	: 92°, 272°
ROOF	: COMPOSITION SHINGLE
RAFTER/TRUSS SIZE	: 2X8 RAFTER @ 16" O.C.
ATTACHMENT TYPE	: UNIRAC: SFM INFINITY MICRORAIL WITH UNIRAC SFM INFINITY RAIL-LESS
BATTERY	: TESLA: POWERWALL 2
BATTERY QTY.	: 2
MAIN SERVICE PANEL	: EXISTING 200 AMPS MSP WITH (E) 200 AMPS MAIN BREAKER ON END FED
INTERCONNECTION	: GATEWAY INTERCEPTS UTILITY FEED
OCPD RATING	: 120AMPS
UTILITY	: SOUTH RIVER ELEC MEMBER CORP

## CITY NOTES:

THIS PROJECT COMPLIES WITH THE FOLLOWING:  
 2015 INTERNATIONAL BUILDING CODE (IBC)  
 2015 INTERNATIONAL RESIDENTIAL CODE (IRC)  
 2015 INTERNATIONAL MECHANICAL CODE (IMC)  
 2015 INTERNATIONAL PLUMBING CODE (IPC)  
 2017 INTERNATIONAL FUEL GAS CODE (IFGC)  
 2017 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)  
 2015 INTERNATIONAL EXISTING BUILDING CODE (IEBC)  
 2017 INTERNATIONAL SWIMMING POOL AND SPA CODE (ISpsc)  
 2020 NATIONAL ELECTRICAL CODE (NEC)  
 AS ADOPTED BY **HARNETT COUNTY (NC)**

CONDUIT AND CONDUCTOR SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS.

ALL SOLAR ENERGY SYSTEM EQUIPMENT SHALL BE SCREENED TO THE MAXIMUM EXTENT POSSIBLE AND SHALL BE PAINTED A COLOR SIMILAR TO THE SURFACE UPON WHICH THEY ARE MOUNTED.

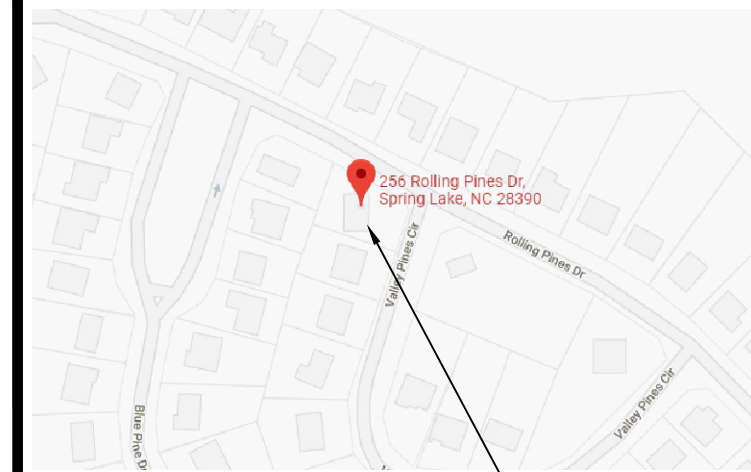
MODULES SHALL BE TESTED, LISTED AND IDENTIFIED WITH FIRE CLASSIFICATION IN ACCORDANCE WITH UL 2703. SMOKE AND CARBON MONOXIDE ALARMS ARE REQUIRED PER SECTION R314 AND 315 TO BE VERIFIED AND INSPECTED BY INSPECTOR IN THE FIELD.

### INSTALLATION NOTES:

DIG ALERT (811) TO BE CONTACTED AND COMPLIANCE WITH EXCAVATION SAFETY PRIOR TO ANY EXCAVATION TAKING PLACE

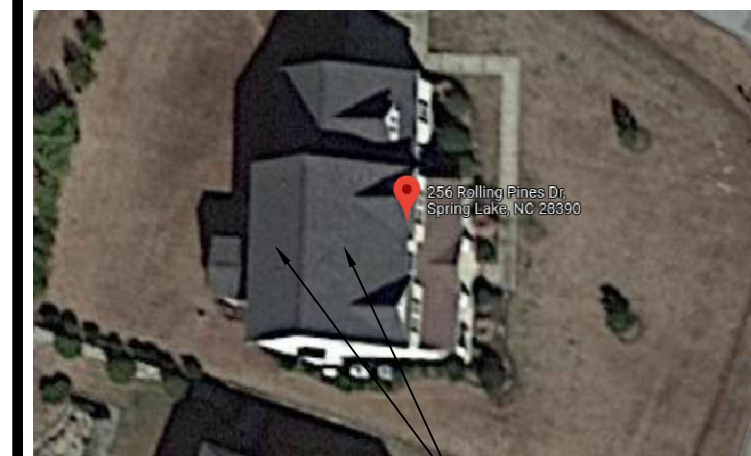
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## SITE LOCATION:



SITE LOCATION

## HOUSE AERIAL VIEW:



MODULE LOCATION

### TABLE OF CONTENTS

PV-1	SITE LOCATION AND HOUSE AERIAL VIEW
PV-2	SITE PLAN
PV-2A	ROOF PLAN WITH MODULES LAYOUT
PV-3	MOUNTING DETAILS
PV-4	THREE LINE DIAGRAM
PV-5	EXISTING SERVICE PANEL
PV-6	NOTES AND EQUIPMENT LIST
PV-7	LABELS
PV-7A	SITE PLACARD
PV-8	OPTIMIZER CHART
PV-9 & 10	SAFETY PLAN

CLIENT:

**KATHLEEN FLOCKE**

256 ROLLING PINES DRIVE,  
 SPRING LAKE, NC 28390

REVISIONS:

DESCRIPTION	DATE	REVISION

DATE: 9/30/2021

DESIGN BY: JRM

JOB NO.: F107250

TITLE:

SITE LOCATION AND  
 HOUSE AERIAL VIEW

SHEET:

**PV-1**



FREEDOM FOREVER NORTH CAROLINA  
 LLC

415 INDUSTRIAL CT., GREER, SC 29651  
 Tel: (800) 385-1075

ELECTRICAL CONTRACTOR NO:  
 ELECTRICAL CONTRACTOR U.34043
















GREG ALBRIGHT

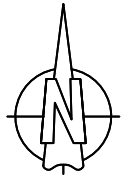
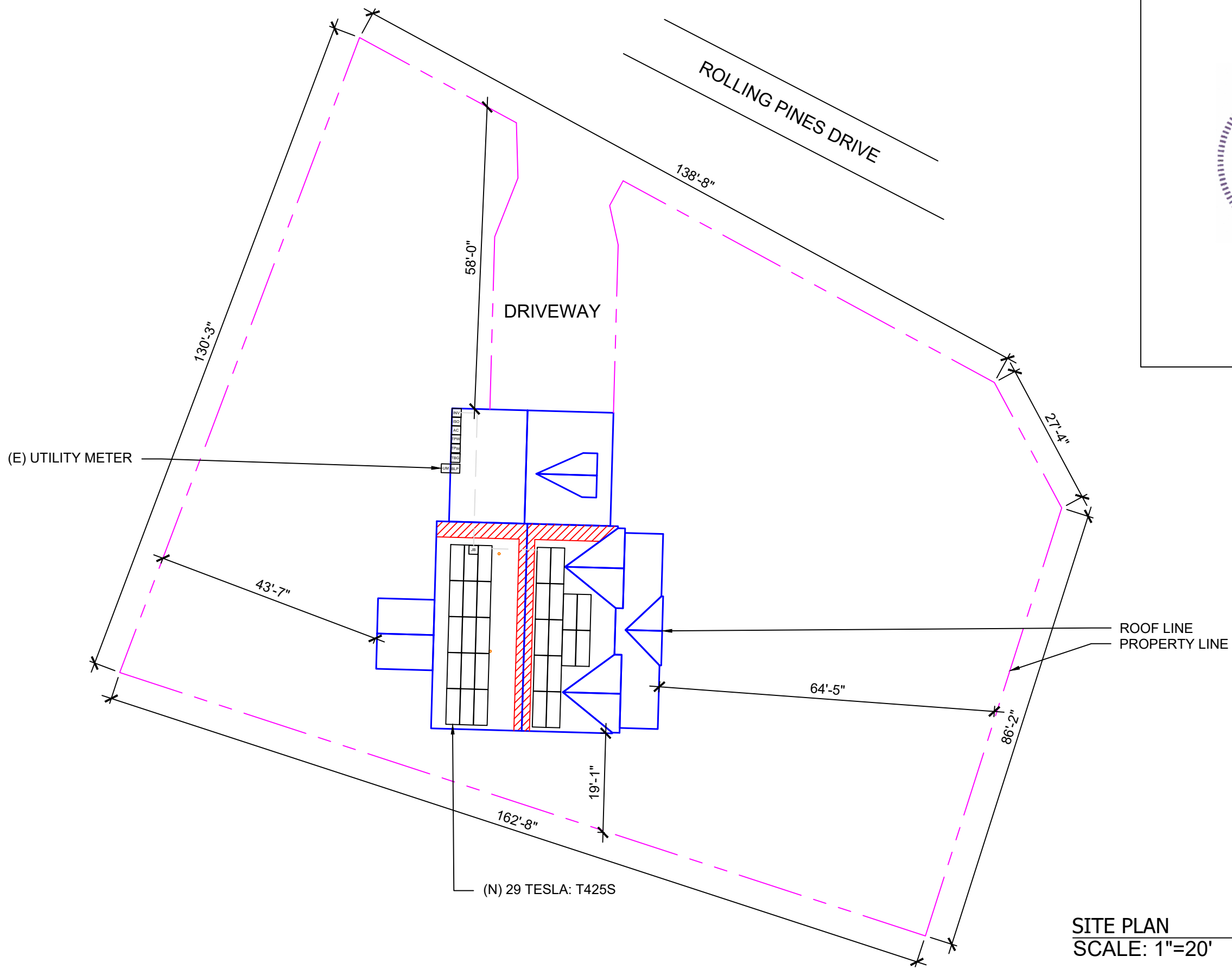
ROOF AREA : 3221.00 SQ FT

PV SYSTEM  
 12.325 kW-DC  
 10.000 kW-AC



LEGEND:

-  CHIMNEY
-  PIPE VENT
-  MODULES
-  CONDUIT
-  SETBACK
-  AC DISCONNECT
-  UTILITY METER
-  PRODUCTION METER
-  MSP
-  JUNCTION BOX
-  INVERTER
-  BACKUP LOAD PANEL
-  NON BACKUP LOAD PANEL
-  TESLA BACKUP GATEWAY 2
-  TESLA POWERWALL 2

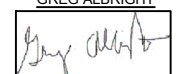


SITE PLAN  
 SCALE: 1"=20'

1



**FREEDOM FOREVER NORTH CAROLINA LLC**  
 415 INDUSTRIAL CT., GREER, SC 29651  
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ELECTRICAL CONTRACTOR NO. U.34043  
 GREG ALBRIGHT  


CLIENT: **KATHLEEN FLOCKE**  
 256 ROLLING PINES DRIVE,  
 SPRING LAKE, NC 28390

REVISIONS:		
DESCRIPTION	DATE	REVISION

DATE:	9/30/2021
DESIGN BY:	JRM
JOB NO.:	F107250

TITLE: **SITE PLAN**

SHEET: **PV-2**

ROOF AREA : 3221 SQ FT

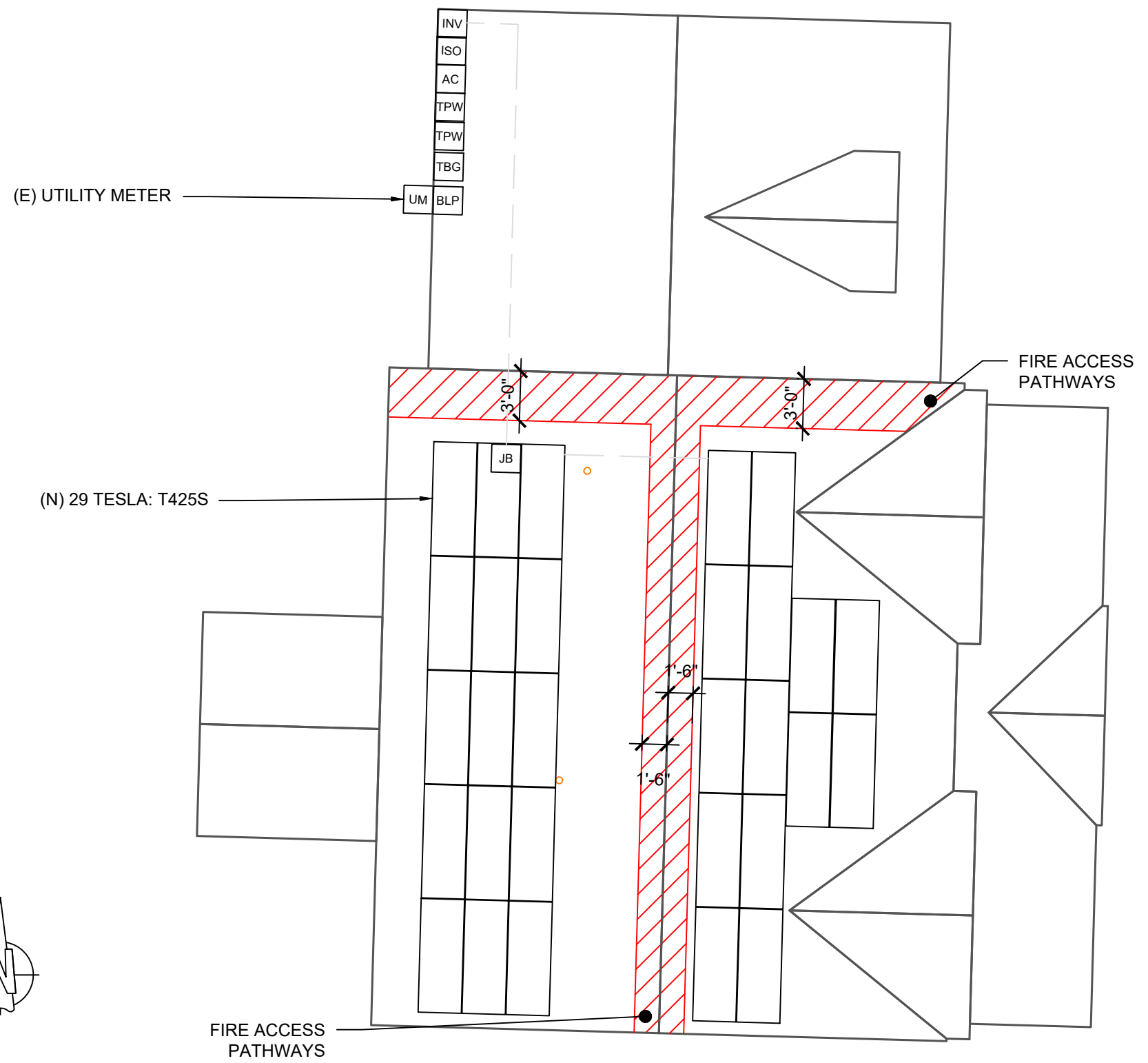
PV SYSTEM  
 12.325 KW-DC  
 10.000 KW-AC

ROOF AREA STATEMENT								
ROOF	MODULES QTY	PITCH	AZIMUTH	ROOF AREA	ARRAY AREA	ARRAY COVERAGE %	SYSTEM DISTRIBUTED WEIGHT	ATTACHMENT POINT-LOAD
1	14	40°	92°	877 SQ FT	327.60 SQ FT	21.07%	2.38 PSF	18.82 LBS
2	15	40°	272°	712 SQ FT	351.00 SQ FT			



- LEGEND:**
- CHIMNEY
  - PIPE VENT
  - MODULES
  - CONDUIT
  - SETBACK
  - AC DISCONNECT
  - UTILITY METER
  - PRODUCTION METER
  - MSP
  - JUNCTION BOX
  - INVERTER
  - BACKUP LOAD PANEL
  - NON BACKUP LOAD PANEL
  - TESLA BACKUP GATEWAY 2
  - TESLA POWERWALL 2

- NOTES:**
1. EMT CONDUIT ATTACHED TO THE ROOF USING CONDUIT MOUNTS
  2. ATTACHED CLAMPS AT 25% FROM THE EDGE AND 50% FROM THE CENTER OF THE MODULES
  3. JUNCTION BOX IS MOUNTED TO THE RAIL.



ROOF PLAN  
 SCALE: 1/8" = 1'-0"

1

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REVISIONS:

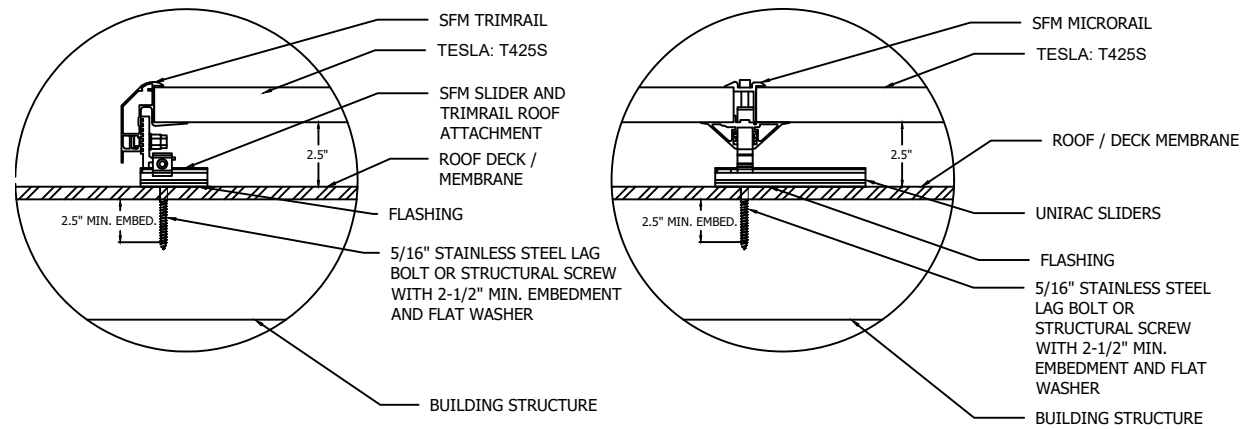
DESCRIPTION	DATE	REVISION

DATE:	9/30/2021
DESIGN BY:	JRM
JOB NO.:	F107250

TITLE: **ROOF PLAN W/  
 MODULES LAYOUT**

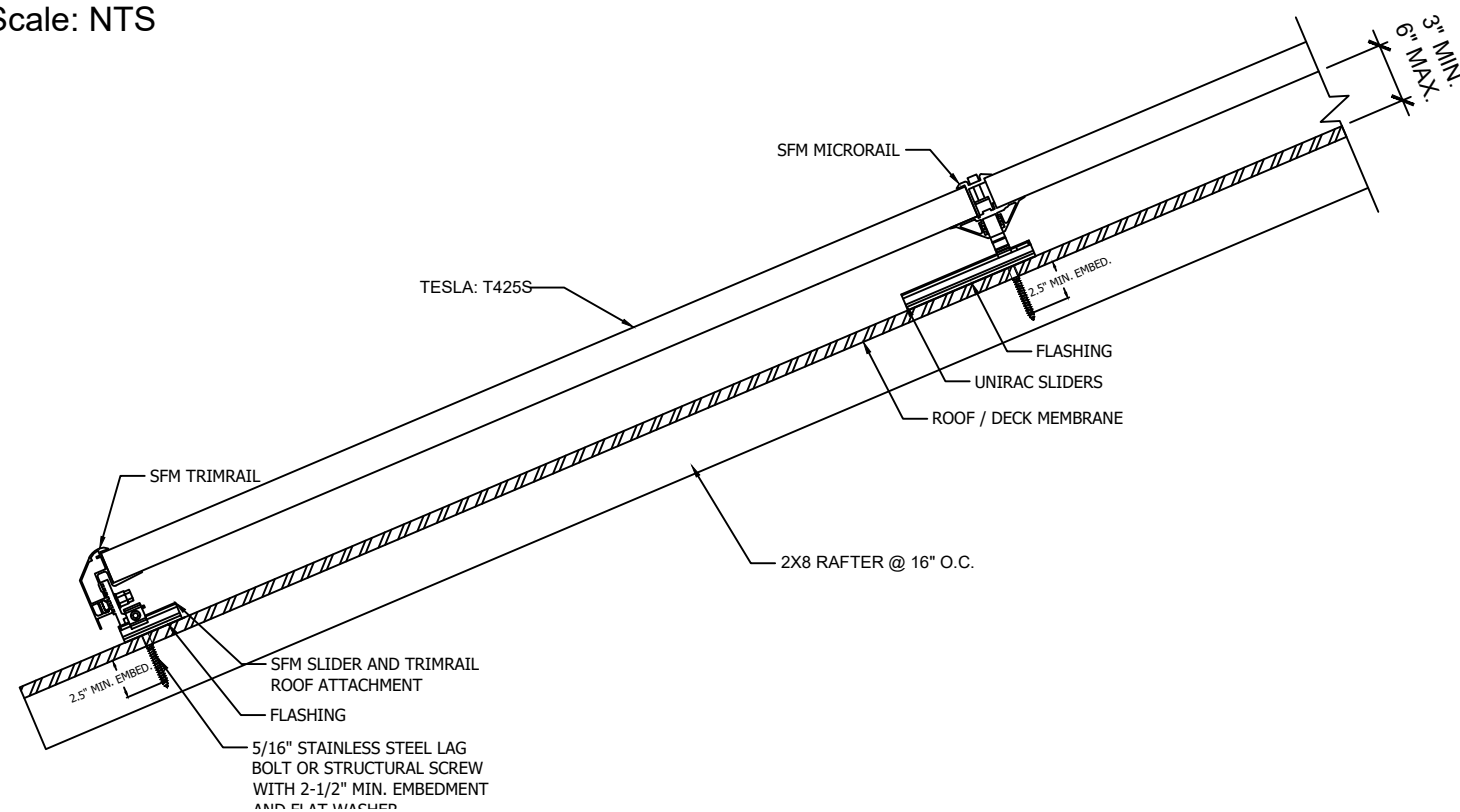
SHEET: **PV-2A**

Structural Only



ATTACHMENT DETAIL

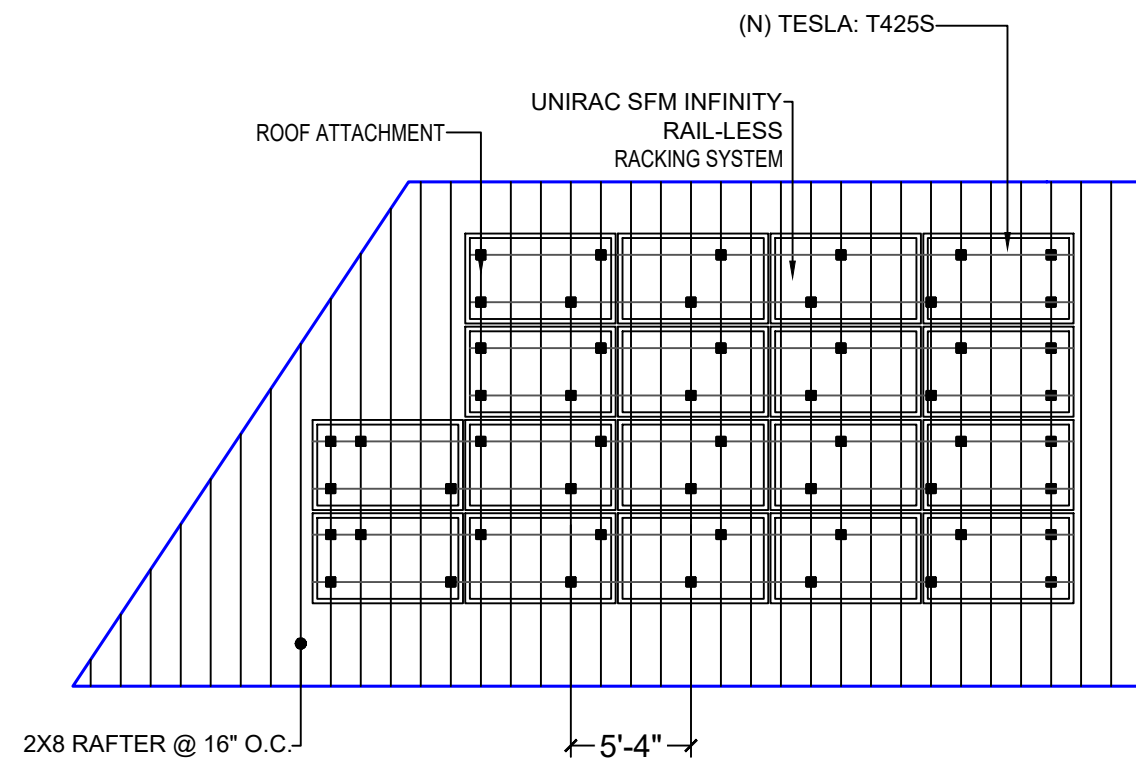
Scale: NTS



SOLAR PV ARRAY SECTION VIEW

Scale: NTS

MAX ATTACHMENT SPAN - 4'



PARTIAL ROOF FRAMING PLAN

Scale: NTS

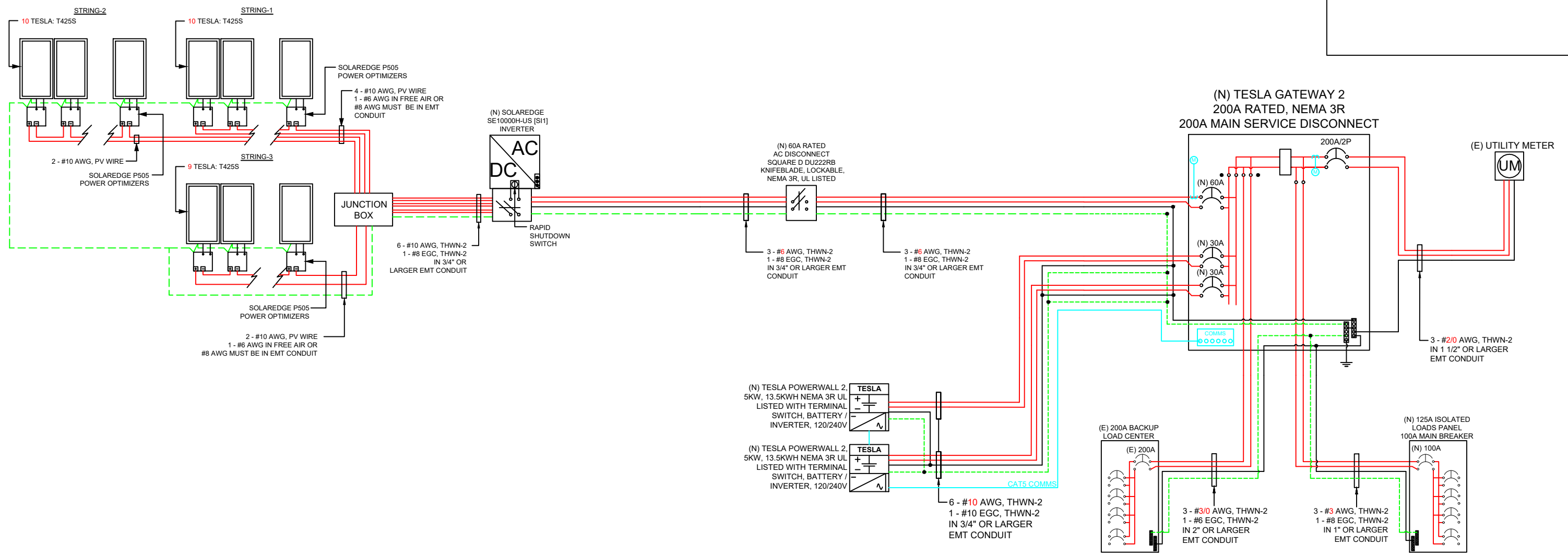
REVISIONS:		
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**BACKFEED BREAKER SIZING**  
 MAX. CONTINUOUS OUTPUT 42A @ 240V  
 42 X 1.25 = 52.50AMPS 120A BREAKER - OK  
 SEE 705.12 OF 2020 NEC  
 200 X 1.20 = 240  
 240 - 200 = 40A ALLOWABLE BACKFEED

**PV SYSTEM**  
 12.325 kW-DC  
 10.000 kW-AC

CONDUCTOR AMPACITY DE-RATE CALCULATION											
EQUIPMENT				WIRE LOCATION	CONDUCTOR QTY.	AWG WIRE SIZE	NEC FACTORS TABLE 310.15(B)(16)	NEC FACTORS TABLE 310.15(B)(2)(a)	CONDUCTOR AMPACITY @90C ADJ.	NEC FACTORS TABLE 310.15(B)(3)(a)	
1	AC	INVERTER	TO	AC DISCONNECT	EXTERIOR WALL	3	6	65	0.94	61.1	1.00
2	AC	AC DISCONNECT	TO	POI	EXTERIOR WALL	3	6	65	0.94	61.1	1.00



NOTE:  
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**freedom FOREVER**  
 FREEDOM FOREVER NORTH CAROLINA LLC  
 415 INDUSTRIAL CT., GREER, SC 29651  
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ELECTRICAL CONTRACTOR NO. U.34043  
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 GREG ALBRIGHT

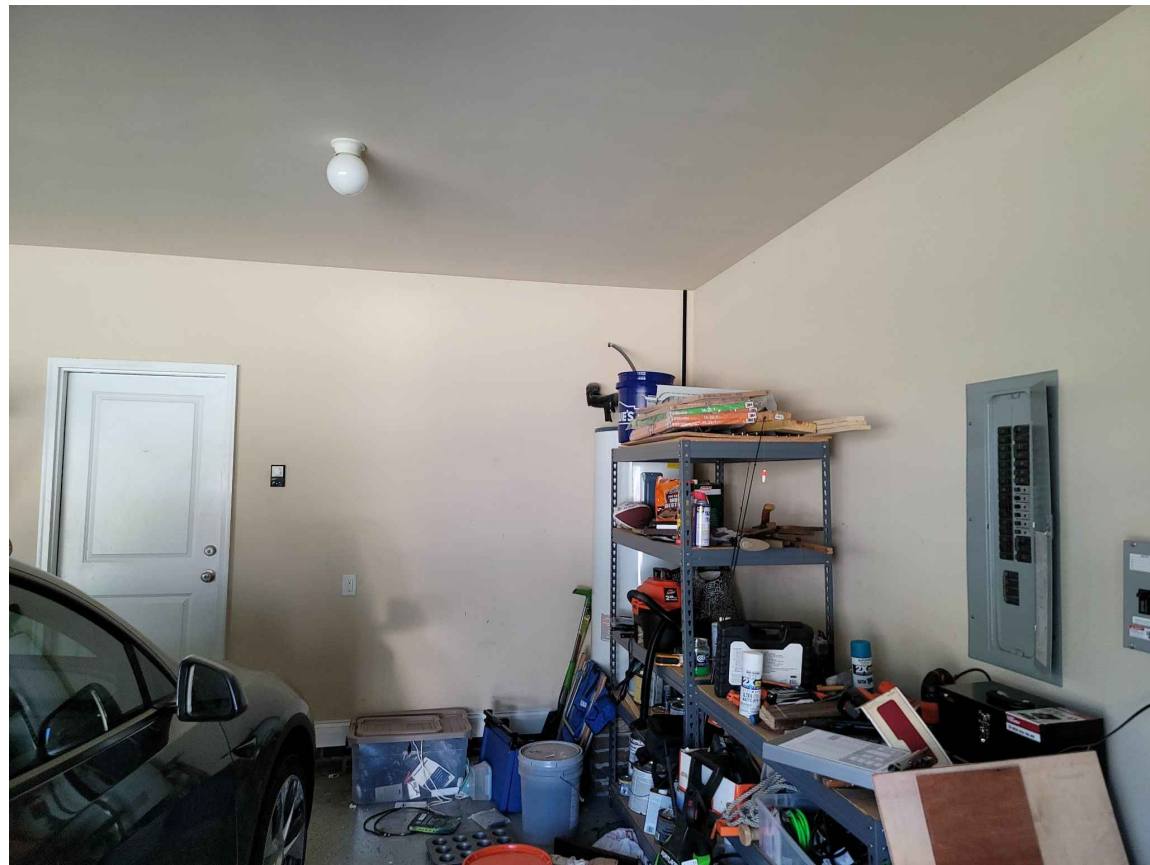
CLIENT: **KATHLEEN FLOCKE**  
 256 ROLLING PINES DRIVE,  
 SPRING LAKE, NC 28390

REVISIONS:		
DESCRIPTION	DATE	REVISION

DATE: 9/30/2021  
 DESIGN BY: JRM  
 JOB NO.: F107250

TITLE: **THREE LINE DIAGRAM**

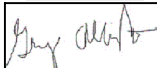
SHEET: **PV-4**



  
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GREG ALBRIGHT



CLIENT:

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256 ROLLING PINES DRIVE,  
 SPRING LAKE, NC 28390

REVISIONS:

DESCRIPTION	DATE	REVISION

DATE: 9/30/2021

DESIGN BY: JRM

JOB NO.: F107250

TITLE:

**EXISTING SERVICE  
 PANEL**

SHEET:

**PV-5**

BACK UP

**SHEET CHECKLIST INTERRUPTING NATURAL GAS**  
 This panel must be installed in accordance with the National Electrical Code (NEC) and the manufacturer's instructions. The installer must verify the correct wiring and labeling of the panel before energizing it. The installer must also verify the correct wiring and labeling of the panel before energizing it. The installer must also verify the correct wiring and labeling of the panel before energizing it.

31	B	MEAT	31	B	MEAT
29	B	B	29	B	B
27	B	AC 5	27	B	B
25	B	B	25	B	B
23	B	DISPOSAL	23	B	B
21	B	LIVING RM	21	B	B
19	B	MICRO WAVE	19	B	B
17	B	SMALL BED ROOM	17	B	B
15	B	BONUS RM	15	B	B
13	B	LIGHTS 4P	13	B	B
11	B	SMALL MASTER BED RM	11	B	B
9	B	LIGHTS CIR DOWN	9	B	B
7	B	SMALL BED RM	7	B	B
5	B	RANGE	5	B	B
3	B	B	3	B	B
1	B	GARAGE GFI	1	B	B

**Typical Wiring Diagram**  
 When installing, observe the instructions for NEC and UL47 for use with AA-8000 AL or CU outlets.

**GE PowerMark Gold™ Load**  
 Type 1 Indoor Enclosure  
 Form No. 1000000000  
 See Panel Label for Breaker Ratings and Labels  
 Form No. 1000000000

REVISIONS:		
DESCRIPTION	DATE	REVISION

DATE:	9/30/2021
DESIGN BY:	JRM
JOB NO.:	F107250

**GENERAL NOTES:**

**MATERIAL LIST:**

QTY.	PART	PART #	DESCRIPTION
29	MODULES	120-425	TESLA: T425S
29	OPTIMIZERS	130-505	P505 SOLAREEDGE POWER OPTIMIZER - FRAME MOUNTED MODULE ADD-ON
1	JUNCTION BOX	480-276	600VDC NEMA 3R UL LISTED JUNCTION BOX
2	CONNECTORS	240-300	STAUBLI / MULTI-CONTACT MC4 CONNECTORS (FEMALE)
2	CONNECTORS	240-301	STAUBLI / MULTI-CONTACT MC4 CONNECTORS (MALE)
2	TESLA POWERWALL	141-000	TESLA: POWERWALL 2
2	TESLA GATEWAY	161-000	TESLA BACKUP GATEWAY 2
2	INVERTER	120-101	SE10000H-US [S11] 240V INVERTER UL1741 SA CERTIFIED INTEGRATED ARC FAULT PROTECTION AND RAPID SHUTDOWN
1	AC DISCONNECT		60A DISCO
1	125/100A NON BACKED UP LOADS PANEL		
53	ROOF ATTACHMENT 1	261-602	UNIRAC: SFM INFINITY MICRORAIL
51	MICRORAIL 1	261-602	SFM MICRORAIL 2 INCH
21	SFM TRIM 1	241-253	FLASHKIT SFM TRIM COMP DARK
55	SFM SLIDER 1	261-603	FLASHKIT SFM SLIDER COMP DARK
16	BONDING CLAMP 1	221-100	SFM N/S BONDING CLAMP
7	BONDING CLAMP 1	241-404	SFM TRIM BONDING CLAMP
31	MOUNT ASSEMBLY 1	241-405	MLPE MOUNT ASSY
18	SFM SPLICE 1	261-604	SFM SPLICE
4	SFM ATTACHED SPLICE 1	211-101	SFM ATTACHED SPLICE 8 INCH
24	TRIMRAIL 1	261-606	SFM TRIMRAIL UNIV CLIP W/ HDW
8	TRIM SPLICE 1	261-605	SFM TRIM SPLICE DRK
13	TRIMRAIL 1	211-115	SFM TRIMRAIL UNIV DRK
29	GROUND LUG 1	260-585	ILSCO GROUND LUG
29	TRIM END CAPS 1		UNIRAC SFM TRIM END CAPS

**BREAKER SIZES:**

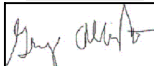
60A PV BREAKER  
 2, 30A PW BREAKERS  
 200A MAIN BREAKER

**SERVICE:**



ELECTRICAL CONTRACTOR NO:  
 ELECTRICAL CONTRACTOR U.34043

GREG ALBRIGHT



CLIENT:

**KATHLEEN FLOCKE**

256 ROLLING PINES DRIVE,  
 SPRING LAKE, NC 28390

REVISIONS:

DESCRIPTION	DATE	REVISION

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DESIGN BY: JRM

JOB NO.: F107250

TITLE:

NOTES AND  
 EQUIPMENT LIST

SHEET:

PV-6



**MAIN PHOTOVOLTAIC SYSTEM DISCONNECT**  
690.13(B)

**DO NOT DISCONNECT UNDER LOAD**  
NEC 690.15 (B) & NEC 690.33(D)(2)

**WARNING**  
SINGLE 120-VOLT SUPPLY DO NOT CONNECT MULTIWIRED BRANCH CIRCUITS  
NEC 710.15(C) & 692.9 (C)

**WARNING** DUAL POWER SOURCE SECOND SOURCE IS PHOTOVOLTAIC SYSTEM  
NEC 705.12(D) & NEC 690.59

**WARNING**  
TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL  
NEC 110.27(C) & OSHA 1910.145(F)(7)

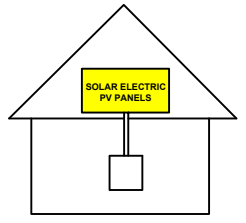
**WARNING**  
ELECTRICAL SHOCK HAZARD  
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION  
706.15(C)(4) & 690.13(B)

**WARNING**  
THIS EQUIPMENT FED BY MULTIPLE SOURCES: TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN POWER SUPPLY SHALL NOT EXCEED AMPACITY OF BUSBAR  
NEC 705.12(B)(3)(3)

**WARNING**  
THE DISCONNECTION OF THE GROUNDED CONDUCTOR(S) MAY RESULT IN OVERVOLTAGE ON THE EQUIPMENT  
NEC 690.31(E)

**SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN**

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY



IFC 605.11.3.1(1) & 690.56(C)

**CAUTION**  
PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED  
NEC 705.12(D) & NEC 690.59

**WARNING**  
POWER SOURCE OUTPUT CONNECTION. DO NOT RELOCATE THIS OVERCURRENT DEVICE.  
NEC 705.12(C) & NEC 690.59

**WARNING**  
ARC FLASH AND SHOCK HAZARD APPROPRIATE PPE REQUIRED  
24 INCH FLASH HAZARD BOUNDARY  
3 CALCMF2 FLASH HAZARD AT 18 INCHES  
480 VAC SHOCK HAZARD WHEN COVER IS REMOVED  
42 INCH LIMITED APPROACH  
12 INCH RESTRICTED APPROACH - 500 V CLASS 00 GLOVES  
1 INCH PROHIBITED APPROACH - 500 V CLASS 00 GLOVES  
LOCATION: 256 ROLLING PINES DRIVE, SPRING LAKE, NC 28390

**PHOTOVOLTAIC AC DISCONNECT**  
NEC 690.13(B)

**PHOTOVOLTAIC AC DISCONNECT**  
RATED AC OUTPUT CURRENT: **42.00A**  
NOMINAL OPERATING AC VOLTAGE: **240V**  
NEC 690.54

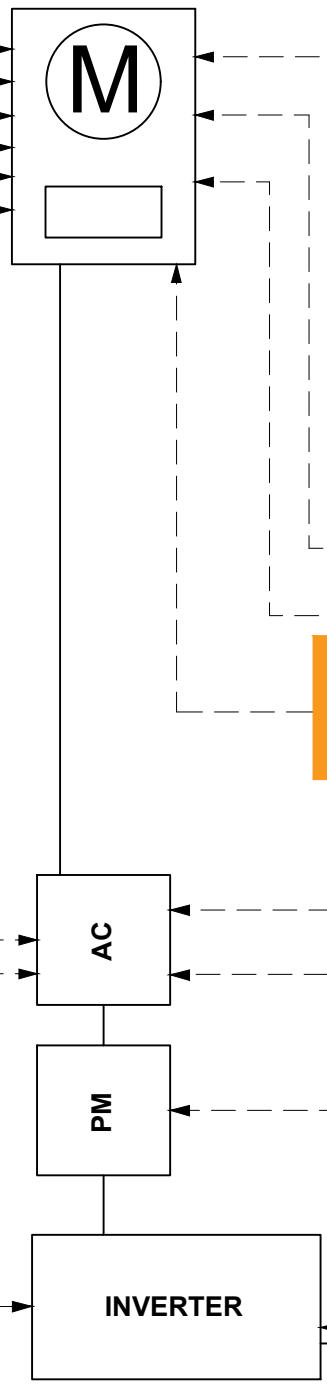
**WARNING** DUAL POWER SOURCE SECOND SOURCE IS PHOTOVOLTAIC SYSTEM  
NEC 705.12(D) & NEC 690.59

**SOLAR PV DC CIRCUIT**  
EVERY 10' ON CONDUIT AND ENCLOSURES  
NEC 690.31(O)(2)

**PHOTOVOLTAIC POWER SOURCE**  
EVERY 10' ON CONDUIT AND ENCLOSURES  
NEC 690.31(D)(2)

**NOTES:**

- NEC ARTICLES 690 AND 705 AND NEC SECTION R324 MARKINGS SHOWN HEREON.
- ALL MARKING SHALL CONSIST OF THE FOLLOWING:
  - UV RESISTANT SIGN MATERIAL WITH ENGRAVED OR MACHINE PRINTED LETTERS OR ELECTRO-PLATING.
  - RED BACKGROUND COLOR WHITE TEXT AND LINE WORK.
  - AERIAL FONT.
- ALL SIGNS SHALL BE SIZED APPROPRIATELY AND PLACED IN THE LOCATIONS SPECIFIED. SIGNAGE CANNOT BE HAND-WRITTEN.
- SIGNS SHALL BE ATTACHED TO THE SERVICE EQUIPMENT WITH POP-RIVETS OR SCREWS.



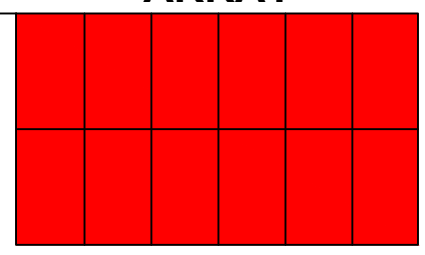
**PHOTOVOLTAIC DC DISCONNECT**  
NEC 690.13(B)

**PHOTOVOLTAIC DC DISCONNECT**  
MAXIMUM DC VOLTAGE OF PV SYSTEM  
NEC 690.53

**WARNING**  
ELECTRICAL SHOCK HAZARD  
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION  
DC VOLTAGE IS ALWAYS PRESENT WHEN SOLAR MODULES ARE EXPOSED TO SUNLIGHT  
706.15(C)(4) & 690.13(B)

**WARNING**  
ELECTRICAL SHOCK HAZARD  
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION  
706.15(C)(4) & 690.13(B)

**WARNING**  
TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL  
NEC 110.27(C) & OSHA 1910.145(F)(7)



NEC 690.31(G)(3) & (4)

REVISIONS:		
DESCRIPTION	DATE	REVISION

DATE:	9/30/2021
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JOB NO.:	F107250

ENERGY STORAGE SYSTEM ON SITE  
LOCATED INSIDE

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

**WARNING**

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

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

**CAUTION**  
DO NOT ADD NEW LOADS

**BACKUP LOAD CENTER**



FREEDOM FOREVER NORTH CAROLINA  
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REVISIONS:

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JOB NO.: F107250

TITLE:

**LABELS**

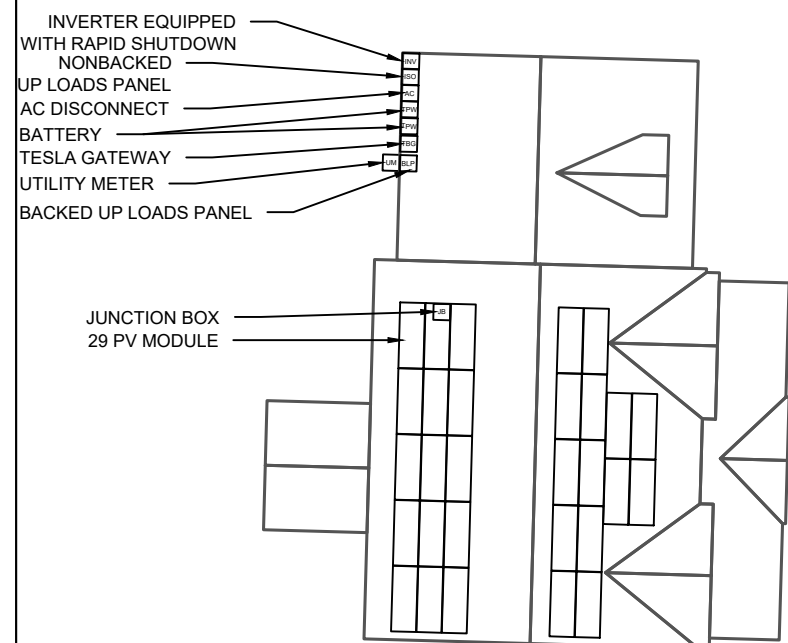
SHEET:

**PV-7  
(2)**

**CAUTION:**

MULTIPLE SOURCES OF POWER LOCATED AS SHOWN.  
DANGEROUS VOLTAGE MAY BE PRESENT AT ALL TIMES

ROLLING PINES DRIVE



6X8" TYP - NEC 705.10

**NOTES:**

1. NEC ARTICLES 690 AND 705 AND NEC SECTION R324 MARKINGS SHOWN HEREON.
2. ALL MARKING SHALL CONSIST OF THE FOLLOWING:
  - A. UV RESISTANT SIGN MATERIAL WITH ENGRAVED OR MACHINE PRINTED LETTERS OR ELECTRO-PLATING.
  - B. RED BACKGROUND COLOR WHITE TEXT AND LINE WORK.
  - C. AERIAL FONT.
3. ALL SIGNS SHALL BE SIZED APPROPRIATELY AND PLACED IN THE LOCATIONS SPECIFIED. SIGNAGE CANNOT BE HAND-WRITTEN.
3. SIGNS SHALL BE ATTACHED TO THE SERVICE EQUIPMENT WITH POP-RIVETS OR SCREWS.



**FREEDOM FOREVER NORTH CAROLINA LLC**  
415 INDUSTRIAL CT., GREER, SC 29651  
Tel: (800) 385-1075

ELECTRICAL CONTRACTOR NO:  
ELECTRICAL CONTRACTOR U.34043

GREG ALBRIGHT

CLIENT:

**KATHLEEN FLOCKE**

256 ROLLING PINES DRIVE,  
SPRING LAKE, NC 28390

REVISIONS:

DESCRIPTION	DATE	REVISION

DATE: 9/30/2021

DESIGN BY: JRM

JOB NO.: F107250

TITLE:

**LABELS**

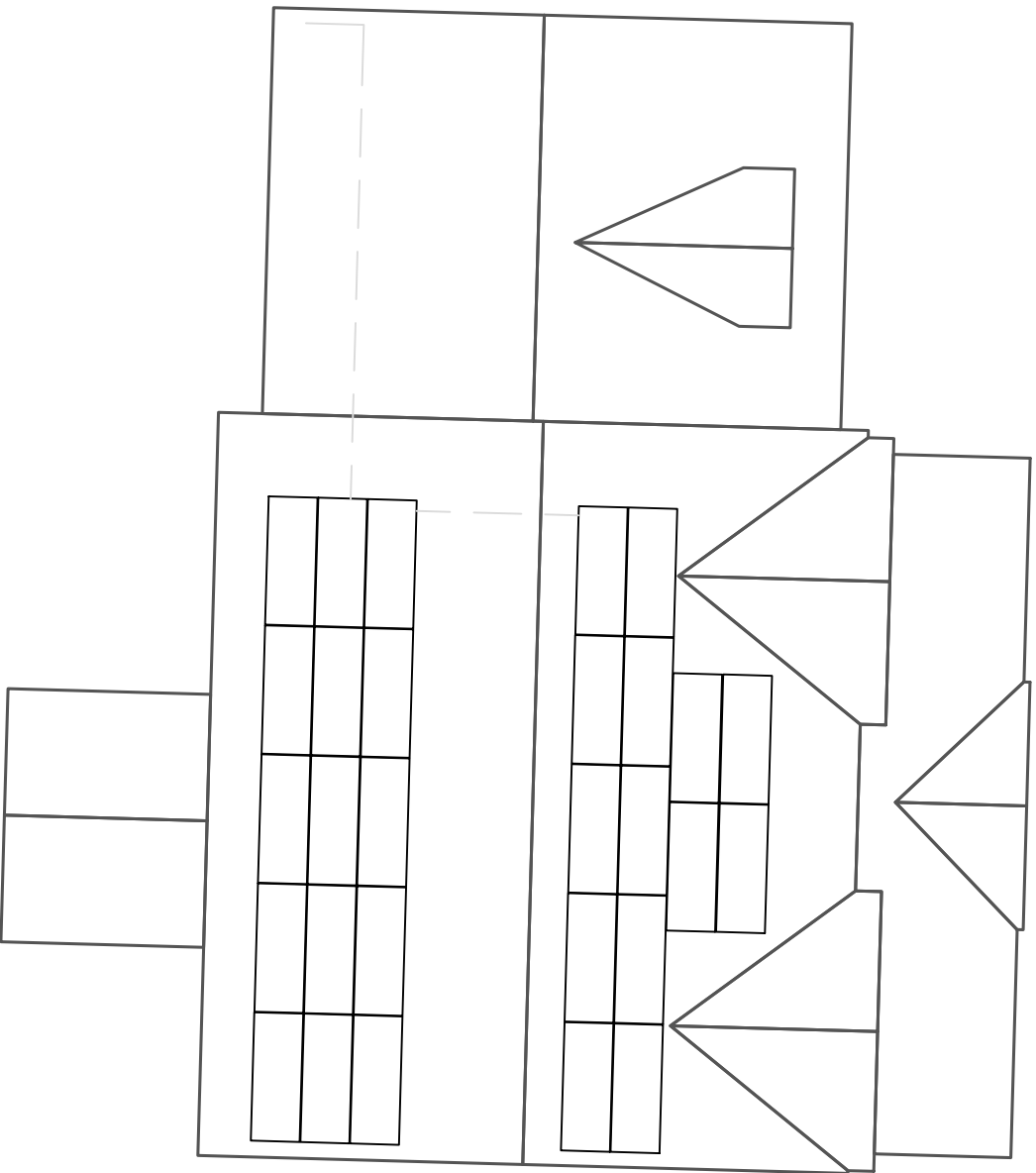
SHEET:

**PV-7A**

# SOLAREEDGE OPTIMIZER CHART

1-10    11-20    21-30    31-40    41-50    51-60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10

REVISIONS:		
DESCRIPTION	DATE	REVISION

DATE:	9/30/2021
DESIGN BY:	JRM
JOB NO.:	F107250

# SAFETY PLAN

# MARK UP KEY

## INSTRUCTIONS:

1. USE SYMBOLS IN KEY TO MARK UP THIS SHEET.
2. SAFETY PLAN MUST BE MARKED BEFORE JOB STARTS AS PART OF THE PRE-PLAN
3. DOCUMENT ALL ADDITIONAL HAZARDS ON THIS PAGE & MAKE NOTES ON THE JHA SHEET

## IN CASE OF EMERGENCY

NEAREST HOSPITAL OR OCCUPATIONAL/INDUSTRIAL CLINIC

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

### SAFETY COACH CONTACT INFORMATION

NAME: \_\_\_\_\_

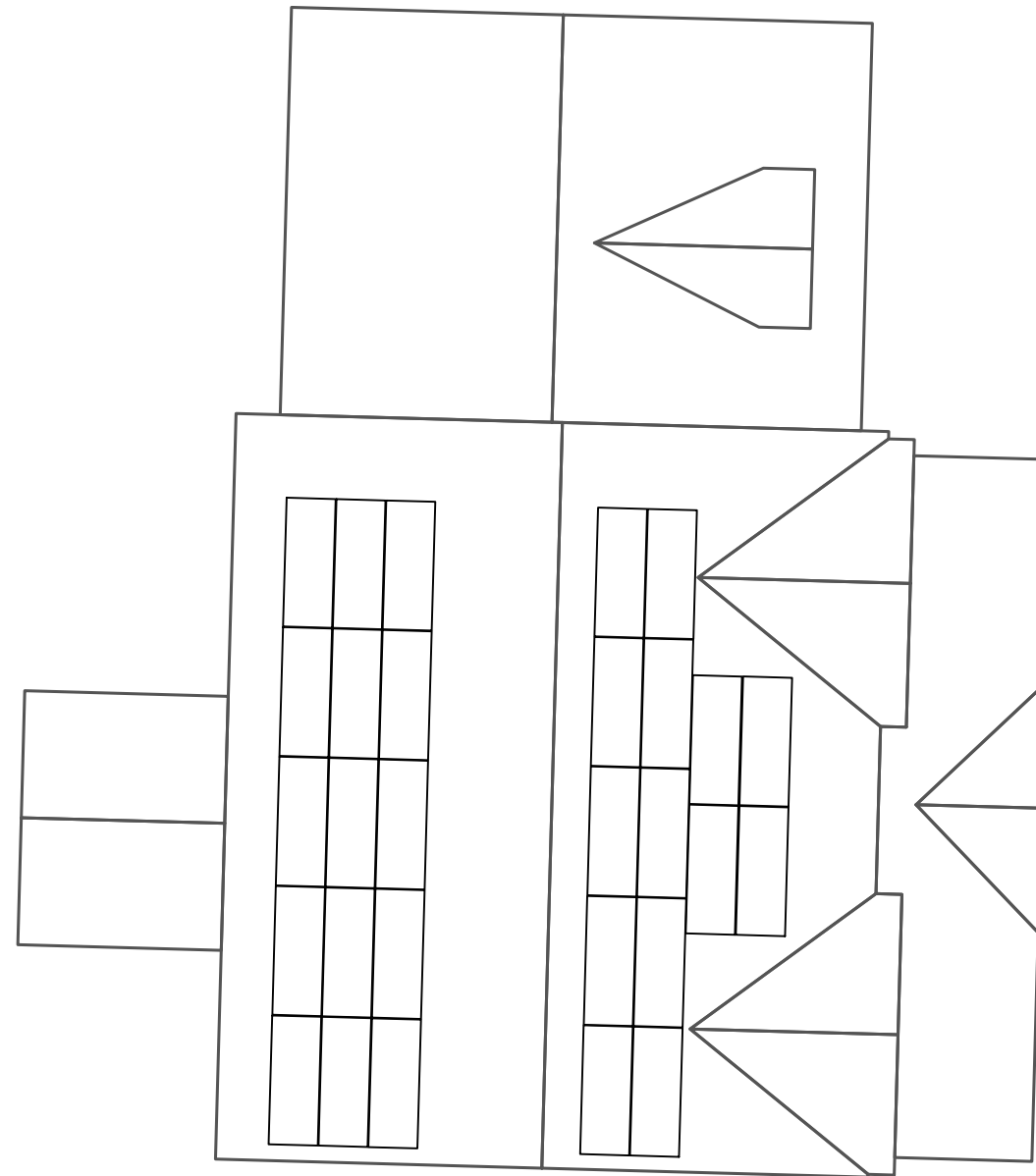
ADDRESS: \_\_\_\_\_

ALL EMPLOYEES ON SITE SHALL BE MADE AWARE OF THE SAFETY PLAN AND SIGN INDICATING THAT THEY ARE AWARE OF THE HAZARDS ON-SITE AND THE PLAN FOR WORKING SAFELY.

NAME

SIGNATURE


DATE: \_\_\_\_\_ TIME: \_\_\_\_\_



- P PERMANENT ANCHOR
- T TEMPORARY ANCHOR
- IL INSTALLER LADDER
- B JUNCTION / COMBINER BOX
- S STUB-OUT
- SKYLIGHT
- NO LADDER ACCESS (STEEP GRADE OR GROUND LEVEL OBSTRUCTIONS)
- RESTRICTED ACCESS
- CONDUIT
- GAS GAS SHUT OFF
- H<sub>2</sub>O WATER SHUT OFF
- 7 SERVICE DROP
- Z POWER LINES

REVISIONS:		
DESCRIPTION	DATE	REVISION

DATE:	9/30/2021
DESIGN BY:	JRM
JOB NO.:	F107250

# JOB HAZARD ANALYSIS

Crew leader to fill out all sections below, hold a pre-job safety meeting with all personnel, and upload this completed document and the Safety Plan to Site Capture

### Ladder Access

- Ladders must be inspected before each use.
- Extension ladders must be set up on a firm and level surface at a 4-to-1 rise to run angle (or 75 degrees) and the top must be secured to the structure. Extension style ladders placed on uneven, loose or slippery surfaces must additionally have the base firmly anchored or lashed so the base will not slip out.
- Extension ladders must be used with walk-through devices or the ladder must extend 36" above the stepping off point.
- A-frame ladders must only be climbed with the ladder spreader bars locked in the open position; A-frame ladders shall not be climbed while in the closed position (ex, closed and used while leaned against a structure).

Additional notes:

### Mobile Equipment

- Only Qualified operators will operate equipment; operators must maintain a certification on their person for the equipment being operated.
- Type(s) of mobile equipment (Type/Make/Model):
- Qualified operator(s):

### Material Handling and Storage

- Materials will be staged/stored in a way that does not present a hazard to client, personnel or public. Materials stored on the roof will be physically protect from failing or sliding off.

### Fall Protection

- A site-specific plan for fall prevention and protection is required prior to starting work and must remain onsite at all times until work is complete; a fall rescue plan must be outlined and discussed among the crew prior to work start.
- First-person-Up (FPU) must install their anchor and connect before any other task, including installing other anchors. The Last-Person-Down (LPD) must be the only person on a roof uninstalling fall protection.

FPCP (name and title):

FPU and LPD (name and title):

### Electrical Safety

- The Electrical Qualified Person (EQP) is required onsite to perform electrical work.
- All electrical work will be performed with equipment in an electrically safe condition (de-energized) unless approval has been granted prior to work.
- Service drops and overhead electrical hazards will be identified and protected from contact, as necessary.

EQP (name and tile):

### Public Protection

- The safety of the Client and the Public must be maintained at all times.
- The Client and the Public shall be prevented from entering the work zone through the use of barriers and/or signage, as required.
- Company, Client and Public property shall be protect from falling objects.
- Pets (including dogs) shall be secured by their owners prior to work start.
- The client should not leave pets, family members, or others in the charge or care of Employees, Contractors, or Temporary Workers.

Crew leader responsible for communication with the client:

Client and public is excluded from work area by barricades (N/A, Yes, No):

### Training and Pre-Job Safety Briefing

- All employees onsite shall be made aware of the specific hazards of this project and review this HJA during a pre-job briefing, and their signature indicates awareness of site conditions and the plan to eliminate any hazards identified prior to and during the project.

Crew leader (name/title):

Crew member (name/title):

Crew member (name/title):

Crew member (name/title):

Crew member (name/title):

Crew member (name/title):

### Airborne Contaminants:

- Asbestos-containing (Transite) piping (ACP) - Do not disturb (move, drill, cut fracture, etc.)
- Asbestos-containing thermal insulation (ACI) and Asbestos-containing duct wrapping (ACW) - do not disturb, no attic or crawlspace access is allowed if work to be performed could cause exposure to personnel, client or public.

If yes, list specific tasks and protection in place:

### Weather and Environment

- The site supervisor shall forecast the weather conditions at the job site, prior to crew arrival, in order to mitigate any hazards associated with inclement weather (heat, cold, wind, rain, etc.)
- The site supervisor will utilized a portable wind meter (anemometer) to verify actual onsite wind conditions, by checking at the ground and on any elevated work surface (ex, rooftop) prior to work start, at midday and prior to solar panel staging on a roof.
- Elevated work involving the moving or maneuvering of solar panels shall cease at 25mph (sustained wind) until wind subsides.

Forecasted weather maximum temp (degrees F):

### Heat Related Illness Prevention

- Employees shall have access to potable drinking water that is fresh, pure, and suitably cool. The water shall be located as close as practicable to the areas where employees are working. Water shall be supplied in sufficient quantity at the beginning of the work shift to provide at least one quart per employee per hour for drinking for the entire shift. Employees may begin the shift with smaller quantities of water if they identify the location and have effective means for replenishment during the shift to allow employees to drink on quart or more per hour. The frequent drinking of water shall be encouraged.
- Shade shall be present when temperature exceeds 80 degrees Fahrenheit. When the outdoor temperature in the work exceeds 80 degrees Fahrenheit, employees shall have and maintain one or more areas with shade at all times.
- New employees must be acclimatized. New employees will be monitored by their Crew Leader (site supervisor) for the first two (2) weeks of employment or longer when necessary.
- Employees will be allowed and encouraged to implement scheduled breaks during each shift. Employees must take cool-down breaks in the shade any time they feel the need to do so to protect them from overheating. Supervisors are REQUIRED to allow employees any break period they need during high heat conditions.
- Cool Vests are encouraged for all employees at all times during periods of high heat.
- Identify the location of the closet Occupational/Industrial Clinic or Hospital in case a crew member becomes ill.

What is the specific plan to provide and replenish sufficient water for all employees on site?

If offsite replenish is necessary, where will you go to replenish water (location/address):

Who will replenish the drinking water (name):

### Restroom facilities

- Employees shall have access to restroom facilities with hand-washing stations. Use of onsite restroom is at the client's discretion (location is annotated below). If client does not give permission, location of suitable restroom facilities with hand-washing stations offsite will be provided. The onsite supervisor will identify location and make arrangements to ensure all employees have access at any point.

Restroom facilities will be (circle one): Onsite - Offsite

If Offsite, add location name and address:

### Incident Reporting Procedure

- Contact your Site Supervisor

Name:

Phone:

- Contact your Manager

Name:

Phone:

- Contact your Site Supervisor

Name:

Phone:

With: Your full name, phone number, office location, brief description of what happen and when.

### NOTE ADDITIONAL HAZARDS NOT ADDRESSED ABOVE

(add as many as necessary by using additional sheets)

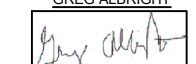
Define the Hazard:	Method/steps to prevent incident:
Define the Hazard:	Method/steps to prevent incident:
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**freedom**  
FOREVER  
FREEDOM FOREVER NORTH CAROLINA  
LLC  
415 INDUSTRIAL CT., GREER, SC 29651  
Tel: (800) 385-1075

ELECTRICAL CONTRACTOR NO:  
ELECTRICAL CONTRACTOR U.34043

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SPRING LAKE, NC 28390

REVISIONS:		
DESCRIPTION	DATE	REVISION

DATE: 9/30/2021

DESIGN BY: JRM

JOB NO.: F107250

TITLE: **SAFETY PLAN**

SHEET: **PV-10**

# Tesla

## Photovoltaic Module

T420S, T425S, and T430S

### Maximum Power

The Tesla module is one of the most powerful residential photovoltaic modules available. Our system requires up to 20 percent fewer modules to achieve the same power as a standard system. The module boasts a high conversion efficiency and a half-cell architecture that improves shade tolerance.

### Beautiful Solar

Featuring our proprietary Zep Groove design, the all-black module connects easily with Tesla ZS components to keep panels close to your roof and close to each other for a blended aesthetic with simple drop-in and precision quarter-turn connections.

### Reliability

Tesla modules are subject to automotive-grade engineering scrutiny and quality assurance, far exceeding industry standards. Modules are certified to IEC / UL 61730 - 1, IEC / UL 61730 - 2 and IEC / UL 61215.

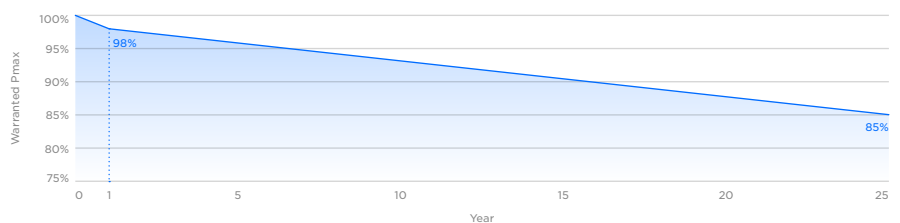


### Limited Warranty

Materials and Processing	25 years
Extra Linear Power Output	25 years

The maximum Pmax degradation is 2% in the 1st year and 0.54% annually from the 2nd to 25th year.

### Linear Power Warranty



# Module Specifications

## Electrical Characteristics

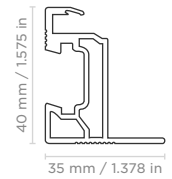
Power Class	T420S		T425S		T430S	
	STC	NOCT	STC	NOCT	STC	NOCT
Test Method	STC	NOCT	STC	NOCT	STC	NOCT
Max Power, $P_{MAX}$ (W)	420	313.7	425	317.4	430	321.1
Open Circuit Voltage, $V_{OC}$ (V)	48.5	45.47	48.65	45.61	48.8	45.75
Short Circuit Current, $I_{SC}$ (A)	11.16	9.02	11.24	9.09	11.32	9.15
Max Power Voltage, $V_{MP}$ (V)	40.90	38.08	41.05	38.22	41.20	38.36
Max Power Current, $I_{MP}$ (A)	10.27	8.24	10.36	8.3	10.44	8.37
Module Efficiency (%)	19.3		19.6		19.8	
STC	1000 W/m <sup>2</sup> , 25°C, AM1.5					
NOCT	800 W/m <sup>2</sup> , 20°C, AM1.5, wind speed 1m/s					

## Temperature Rating (STC)

Temperature Coefficient of $I_{sc}$	+0.040% / °C
Temperature Coefficient of $V_{oc}$	-0.260% / °C
Temperature Coefficient of $P_{MAX}$ (W)	-0.331% / °C

## Mechanical Loading

Front Side Design Load	3600 Pa   75 lb/ft <sup>2</sup>
Rear Side Design Load	1600 Pa   33 lb/ft <sup>2</sup>
Hailstone Test	25 mm Hailstone at 23 m/s

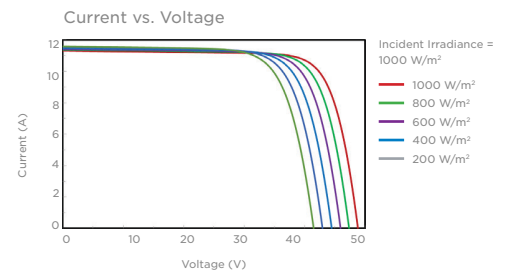
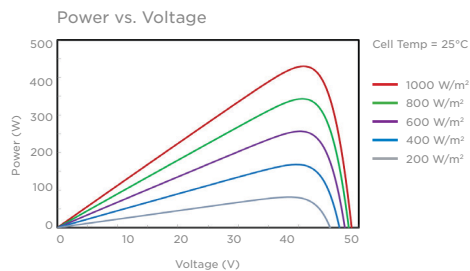
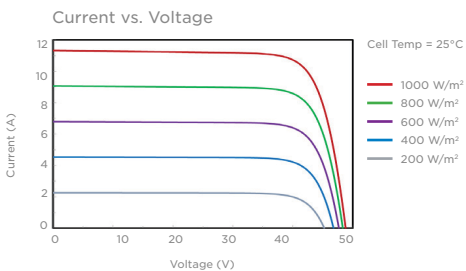
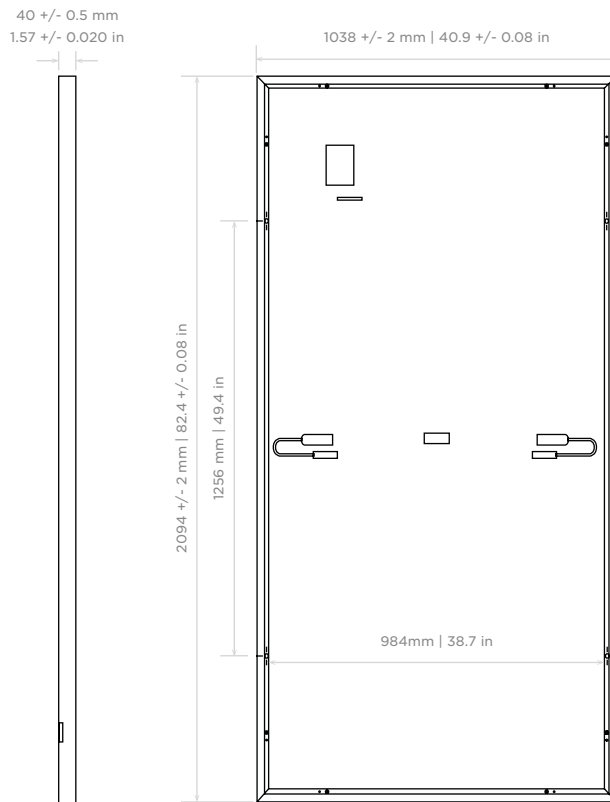


## Mechanical Parameters

Cell Orientation	144 (6 x 24)
Junction Box	IP68, 3 diodes
Cable	4 mm <sup>2</sup>   12 AWG, 1400 mm   55.1 in. Length
Connector	Staubli MC4 or EVO2
Glass	3.2 mm ARC Glass
Frame	Black Anodized Aluminum Alloy
Weight	25.3 kg   55.8 lb
Dimension	2094 mm x 1038 mm x 40 mm 82.4 in x 40.9 in x 1.57 in

## Operation Parameters

Operational Temperature	-40°C - +85°C
Power Output Tolerance	-0 / +5 W
$V_{oc}$ & $I_{sc}$ Tolerance	+/- 3%
Max System Voltage	DC 1000 V (IEC/UL)
Max Series Fuse Rating	20 A
NOCT	45.7 +/- 2°C
Safety Class	Class II
Fire Rating	UL Type 1 or 2





# Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US



12-25  
YEAR  
WARRANTY

INVERTERS

## Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking efficiency
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014 and 2017, per article 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Extremely small
- Built-in module-level monitoring
- Outdoor and indoor installation
- Optional: Revenue grade data, ANSI C12.20 Class 0.5 (0.5% accuracy)

[solaredge.com](http://solaredge.com)

# Single Phase Inverter with HD-Wave Technology for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US

	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US		
<b>OUTPUT</b>									
Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA	
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA	
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac	
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	✓	-	✓	-	-	✓	Vac	
AC Frequency (Nominal)	59.3 - 60 - 60.5 <sup>(1)</sup>							Hz	
Maximum Continuous Output Current @240V	12.5	16	21	25	32	42	47.5	A	
Maximum Continuous Output Current @208V	-	16	-	24	-	-	48.5	A	
GFDI Threshold	1							A	
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes								
<b>INPUT</b>									
Maximum DC Power @240V	4650	5900	7750	9300	11800	15500	17650	W	
Maximum DC Power @208V	-	5100	-	7750	-	-	15500	W	
Transformer-less, Ungrounded	Yes								
Maximum Input Voltage	480							Vdc	
Nominal DC Input Voltage	380				400			Vdc	
Maximum Input Current @240V <sup>(2)</sup>	8.5	10.5	13.5	16.5	20	27	30.5	Adc	
Maximum Input Current @208V <sup>(2)</sup>	-	9	-	13.5	-	-	27	Adc	
Max. Input Short Circuit Current	45							Adc	
Reverse-Polarity Protection	Yes								
Ground-Fault Isolation Detection	600ka Sensitivity								
Maximum Inverter Efficiency	99	99.2						%	
CEC Weighted Efficiency	99						99 @ 240V 98.5 @ 208V	%	
Nighttime Power Consumption	< 2.5							W	
<b>ADDITIONAL FEATURES</b>									
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional), Cellular (optional)								
Revenue Grade Data, ANSI C12.20	Optional <sup>(3)</sup>								
Rapid Shutdown - NEC 2014 and 2017 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect								
<b>STANDARD COMPLIANCE</b>									
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07								
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)								
Emissions	FCC Part 15 Class B								
<b>INSTALLATION SPECIFICATIONS</b>									
AC Output Conduit Size / AWG Range	3/4" minimum / 14-6 AWG				3/4" minimum /14-4 AWG				
DC Input Conduit Size / # of Strings / AWG Range	3/4" minimum / 1-2 strings / 14-6 AWG				3/4" minimum / 1-3 strings / 14-6 AWG				
Dimensions with Safety Switch (HxWxD)	17.7 x 14.6 x 6.8 / 450 x 370 x 174				21.3 x 14.6 x 7.3 / 540 x 370 x 185				in / mm
Weight with Safety Switch	22 / 10	25.1 / 11.4	26.2 / 11.9	38.8 / 17.6				lb / kg	
Noise	< 25				<50				dBA
Cooling	Natural Convection								
Operating Temperature Range	-40 to +140 / -25 to +60 <sup>(4)</sup> (-40°F / -40°C option) <sup>(5)</sup>							°F / °C	
Protection Rating	NEMA 4X (Inverter with Safety Switch)								

<sup>(1)</sup> For other regional settings please contact SolarEdge support  
<sup>(2)</sup> A higher current source may be used; the inverter will limit its input current to the values stated  
<sup>(3)</sup> Revenue grade inverter P/N: SExxxH-US000NNC2  
<sup>(4)</sup> For power de-rating information refer to: <https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf>  
<sup>(5)</sup> -40 version P/N: SExxxH-US000NNU4

# Power Optimizer

For North America

P320 / P340 / P370 / P400 / P405 / P505



POWER OPTIMIZER

## PV power optimization at the module-level

- Specifically designed to work with SolarEdge inverters
- Up to 25% more energy
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch losses, from manufacturing tolerance to partial shading
- Flexible system design for maximum space utilization
- Fast installation with a single bolt
- Next generation maintenance with module-level monitoring
- Meets NEC requirements for arc fault protection (AFCI) and Photovoltaic Rapid Shutdown System (PVRSS)
- Module-level voltage shutdown for installer and firefighter safety

[solaredge.com](http://solaredge.com)

**solar**edge

## / Power Optimizer

For North America

P320 / P340 / P370 / P400 / P405 / P505

Optimizer model (typical module compatibility)	P320 (for 60-cell modules)	P340 (for high-power 60-cell modules)	P370 (for higher-power 60 and 72-cell modules)	P400 (for 72 & 96-cell modules)	P405 (for thin film modules)	P505 (for higher current modules)	
<b>INPUT</b>							
Rated Input DC Power <sup>(1)</sup>	320	340	370	400	405	505	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	48		60	80	125 <sup>(2)</sup>	83 <sup>(2)</sup>	Vdc
MPPT Operating Range	8 - 48		8 - 60	8 - 80	12.5 - 105	12.5 - 83	Vdc
Maximum Short Circuit Current (Isc)	11		10.1		14		Adc
Maximum DC Input Current	13.75		12.63		17.5		Adc
Maximum Efficiency	99.5						%
Weighted Efficiency	98.8					98.6	%
Overvoltage Category	II						
<b>OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREEDGE INVERTER)</b>							
Maximum Output Current	15						Adc
Maximum Output Voltage	60			85			Vdc
<b>OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREEDGE INVERTER OR SOLAREEDGE INVERTER OFF)</b>							
Safety Output Voltage per Power Optimizer	1 ± 0.1						Vdc
<b>STANDARD COMPLIANCE</b>							
EMC	FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3						
Safety	IEC62109-1 (class II safety), UL1741						
RoHS	Yes						
<b>INSTALLATION SPECIFICATIONS</b>							
Maximum Allowed System Voltage	1000						Vdc
Compatible inverters	All SolarEdge Single Phase and Three Phase inverters						
Dimensions (W x L x H)	129 x 153 x 27.5 / 5.1 x 6 x 1.1		129 x 153 x 33.5 / 5.1 x 6 x 1.3	129 x 159 x 49.5 / 5.1 x 6.3 x 1.9	129 x 162 x 59 / 5.1 x 6.4 x 2.3		mm / in
Weight (including cables)	630 / 1.4		750 / 1.7	845 / 1.9	1064 / 2.3		gr / lb
Input Connector	MC4 <sup>(3)</sup>						
Output Wire Type / Connector	Double Insulated; MC4						
Output Wire Length	0.95 / 3.0		1.2 / 3.9				m / ft
Input Wire Length	0.16 / 0.52						m / ft
Operating Temperature Range	-40 - +85 / -40 - +185						°C / °F
Protection Rating	IP68 / NEMA6P						
Relative Humidity	0 - 100						%

<sup>(1)</sup> Rated STC power of the module. Module of up to +5% power tolerance allowed

<sup>(2)</sup> NEC 2017 requires max input voltage be not more than 80V

<sup>(3)</sup> For other connector types please contact SolarEdge

PV System Design Using a SolarEdge Inverter <sup>(4),(5)</sup>	Single Phase HD-Wave	Single phase	Three Phase 208V	Three Phase 480V	
Minimum String Length (Power Optimizers)	P320, P340, P370, P400 P405 / P505	8	10	18	
Maximum String Length (Power Optimizers)		6	8	14	
Maximum String Length (Power Optimizers)		25	25	50 <sup>(6)</sup>	
Maximum Power per String	5700 (6000 with SE7600-US - SE11400-US)	5250	6000 <sup>(7)</sup>	12750 <sup>(8)</sup>	W
Parallel Strings of Different Lengths or Orientations	Yes				

<sup>(4)</sup> For detailed string sizing information refer to: [http://www.solaredge.com/sites/default/files/string\\_sizing\\_na.pdf](http://www.solaredge.com/sites/default/files/string_sizing_na.pdf)

<sup>(5)</sup> It is not allowed to mix P405/P505 with P320/P340/P370/P400 in one string

<sup>(6)</sup> A string with more than 30 optimizers does not meet NEC rapid shutdown requirements; safety voltage will be above the 30V requirement

<sup>(7)</sup> For SE14.4KUS/SE43.2KUS: It is allowed to install up to 6,500W per string when 3 strings are connected to the inverter (3 strings per unit for SE43.2KUS) and when the maximum power difference between the strings is up to 1,000W

<sup>(8)</sup> For SE30KUS/SE33.3KUS/SE66.6KUS/SE100KUS: It is allowed to install up to 15,000W per string when 3 strings are connected to the inverter (3 strings per unit for SE66.6KUS/SE100KUS) and when the maximum power difference between the strings is up to 2,000W

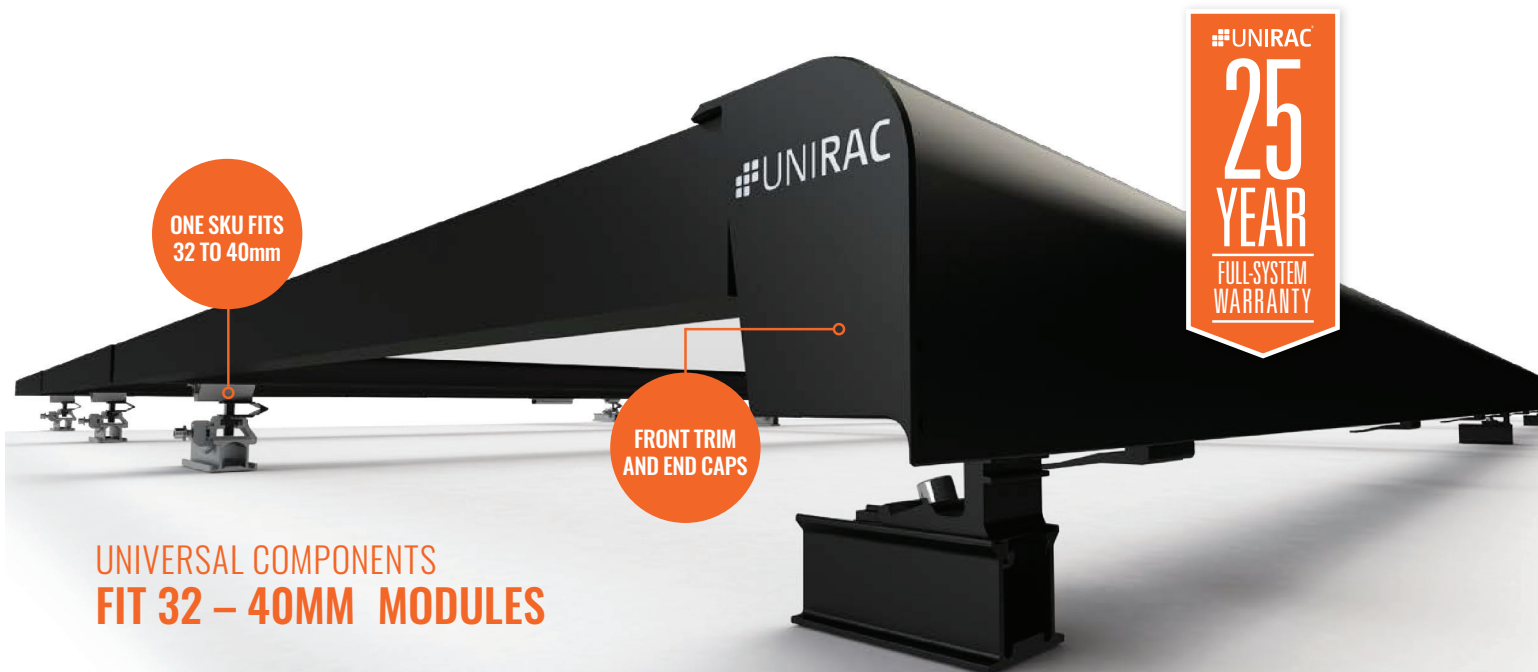
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CE RoHS

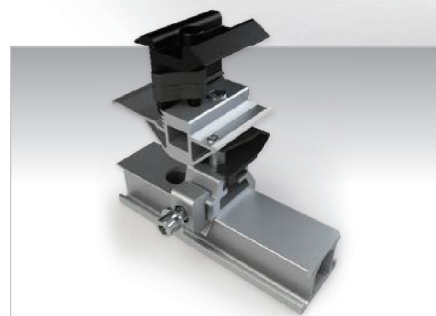
# SFM INFINITY



Take your business to the next level with **SFM INFINITY**, UNIRAC's rail-less PV mounting system for flush mount installations on comp shingle and tile roofs. An advanced 3rd generation product platform in use by top solar contractors nationwide, **SFM INFINITY** optimizes your operations on and off the roof, with approximately 40% less labor, 30% logistics savings, and 20% fewer roof attachments than traditional solar racking. Plus, 87% of homeowners prefer **SFM INFINITY**'s aesthetics.



UNIVERSAL COMPONENTS  
FIT 32 – 40MM MODULES



**SUPERIOR PERFORMANCE**  
Enhance your business with two installs per day and 30% less cost.



**EASY INSTALLATION**  
Pre-assembled components, 20% fewer roof attachments, and level array in seconds with post height adjustment.



**HOMEOWNER PREFERRED**  
More than 4 out of 5 homeowners prefer **SFM INFINITY**'s aesthetics over a leading rail brand.

## REVOLUTIONIZING ROOFTOP SOLAR

FOR QUESTIONS OR CUSTOMER SERVICE VISIT [UNIRAC.COM](http://UNIRAC.COM) OR CALL (505) 248-2702

# SFM INFINITY

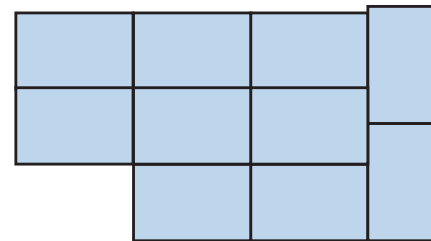
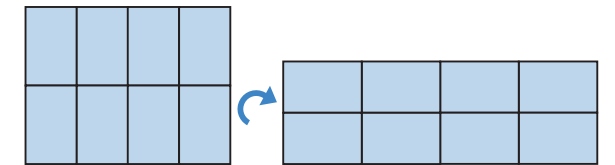
## DESIGN GUIDELINES



While you will see advantages simply from switching to **SFM INFINITY**, the following guidelines will help you to maximize its benefits.

### DEFAULT TO LANDSCAPE

When possible, design in landscape orientation in order to fit more modules on the roof and minimize roof attachments.



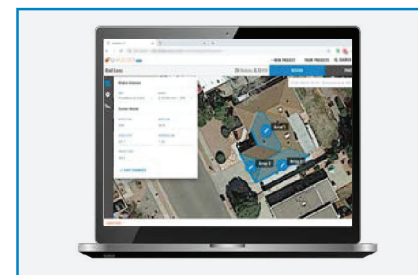
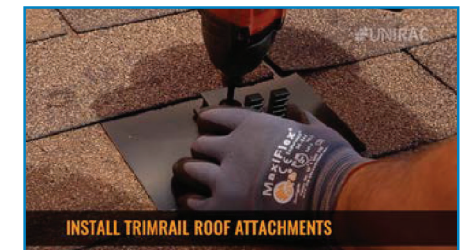
### MIX MODULE ORIENTATIONS

**SFM INFINITY** is easily configured in mixed array shapes and module orientations to maximize array density and to avoid vent pipes and other obstacles. Because mounting locations are not constrained by rails, **SFM INFINITY** has unmatched flexibility to enhance your projects.

### CONSULT THE QUICK TIPS VIDEOS

Visit UNIRAC's mobile-friendly library of short, topic-specific videos which answer common questions and demonstrate how simple it is to install **SFM INFINITY**.

Quick Tips Videos: <https://unirac.com/SFM-Infinity/>



### DESIGN IN U-BUILDER

Layout your arrays in **U-Builder**, UNIRAC's free solar design software, to optimize **SFM INFINITY**'s capabilities, including mixing module orientations and minimizing roof attachments. Quickly create layouts on Google or Bing Maps and generate project documents.

U-Builder: <https://design.unirac.com/>

## REVOLUTIONIZING ROOFTOP SOLAR

FOR QUESTIONS OR CUSTOMER SERVICE VISIT [UNIRAC.COM](http://UNIRAC.COM) OR CALL (505) 248-2702

2.0 Product Description	
Product	Photovoltaic Mounting System, Sun Frame Microrail - Installed Using Unirac Installation Guide, Rev PUB2019MAR01 with Annex North Row Extension Installation Guide Rev PUB2019FEB20
Brand name	Unirac
Description	<p>The product covered by this report is the Sun Frame Micro Rail roof mounted Photovoltaic Rack Mounting System. This system is designed to provide bonding and grounding to photovoltaic modules. The mounting system employs anodized or mill finish aluminum brackets that are roof mounted using the slider, outlined in section 4 of this report. There are no rails within this product, whereas the 3" Micro Rail, Floating Splice, and 9" Attached Splice electrically bond the modules together forming the path to ground.</p> <p>The Micro Rails are installed onto the module frame by using a stainless steel bolt anodized with black oxide with a stainless type 300 bonding pin, torqued to 20 ft-lbs, retaining the modules to the bracket. The bonding pin of the Micro Rail when bolted and torqued, penetrate the anodized coating of the photovoltaic module frame to contact the metal, creating a bonded connection from module to module.</p> <p>The grounding of the entire system is intended to be in accordance with the latest edition of the National Electrical Code, including NEC 250: Grounding and Bonding, and NEC 690: Solar Photovoltaic Systems. Any local electrical codes must be adhered in addition to the national electrical codes. The Grounding Lug is secured to the photovoltaic module, torqued in accordance with the installation manual provided in this document.</p> <p>Other optional grounding includes the use of the Enphase UL2703 certified grounding system, which requires a minimum of 2 micro-inverters mounted to the same rail, and using the same engage cable.</p>
Models	Unirac SFM

2.0 Product Description	
Model Similarity	NA
Ratings	<p><b>Fuse Rating:</b> 30A</p> <p><b>Module Orientation:</b> Portrait or Landscape  <b>Maximum Module Size:</b> 17.98 ft<sup>2</sup>  <b>UL2703 Design Load Rating:</b> 33 PSF Downward, 33 PSF Upward, 10 PSF Down-Slope                      Tested Loads - 50 psf/2400Pa Downward, 50psf/2400Pa Uplift, 15psf/720Pa Down Slope                      Trina TSM-255PD05.08 and Sunpower SPR-E20-327 used for Mechanical Loading</p> <p>Increased size ML test:  <b>Maximum Module Size:</b> 22.3 ft<sup>2</sup>  <b>UL2703 Design Load Rating:</b> 113 PSF Downward, 50 PSF Upward, 30 PSF Down-Slope                      LG355S2W-A5 used for Mechanical Loading test.  <b>Mounting configuration:</b> Four mountings on each long side of panel with the longest span of 24"</p> <p><b>UL2703 Design Load Rating:</b> 46.9 PSF Downward, 40 PSF Upward, 10 PSF Down-Slope                      LG395N2W-A5, LG360S2W-A5 and LG355S2W-A5 used for used for Mechanical Loading test.  <b>Mounting configuration:</b> Six mountings for two modules used with the maximum span of 74.5"</p> <p>Fire Class Resistance Rating:                      - Class A for Steep Slope Applications when using Type 1 Modules. Can be installed at any interstitial gap. Installations must include Trim Rail.                      - Class A for Steep Slope Applications when using Type 2 Modules. Can be installed at any interstitial gap. Installations must include Trim Rail.                      - Class A Fire Rated for Low Slope applications with Type 1 or 2 listed photovoltaic modules. This system was evaluated with a 5" gap between the bottom of the module and the roof's surface</p> <p><i>See section 7.0 illustration # 1 and 1a for a complete list of PV modules evaluated with these racking systems</i></p>
Other Ratings	NA

This authorizes the application of the Certification Mark(s) shown below to the models described in the Product(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to multiple listee model(s) identified on the correlation page of the Listing Report.

This document is the property of Intertek Testing Services and is not transferable. The certification mark(s) may be applied only at the location of the Party Authorized To Apply Mark.

<b>Applicant:</b>	Unirac, Inc	<b>Manufacturer:</b>	Cixi Emeka Aluminum Co. Ltd
<b>Address:</b>	1411 Broadway Blvd NE Albuquerque, NM 87102	<b>Address:</b>	No. 688 ChaoSheng Road Cixi City Zhejiang Province 315311
<b>Country:</b>	USA	<b>Country:</b>	China
<b>Contact:</b>	Klaus Nicolaedis Tom Young	<b>Contact:</b>	Jia Liu Robin Luo
<b>Phone:</b>	505-462-2190 505-843-1418	<b>Phone:</b>	+86-15267030962 +86-13621785753
<b>FAX:</b>	NA klaus.nicolaedis@unirac.com	<b>FAX:</b>	NA
<b>Email:</b>	toddg@unirac.com	<b>Email:</b>	jia.liu@cxymj.com buwan.luo@cxymj.com

**Party Authorized To Apply Mark:** Same as Manufacturer  
**Report Issuing Office:** Lake Forest, CA U.S.A.

**Control Number:** 5003705

**Authorized by:** *Natalie Johnson*  
 for Dean Davidson, Certification Manager



This document supersedes all previous Authorizations to Mark for the noted Report Number.

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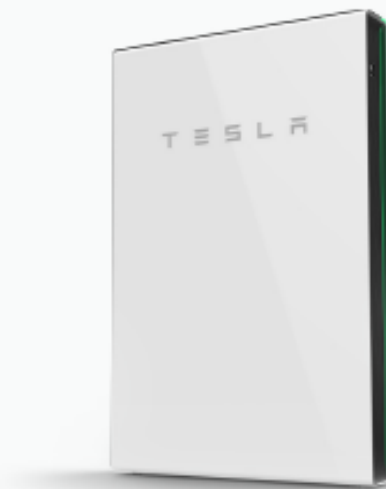
Intertek Testing Services NA Inc.  
 545 East Algonquin Road, Arlington Heights, IL 60005  
 Telephone 800-345-3851 or 847-439-5667 Fax 312-283-1672

<b>Standard(s):</b>	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels [UL 2703: 2015 Ed.1]
<b>Product:</b>	Photovoltaic Mounting System, Sun Frame Microrail - Installed Using Unirac Installation Guide, Rev PUB2019MAR01 with Annex North Row Extension Installation Guide Rev PUB2019FEB20
<b>Brand Name:</b>	Unirac
<b>Models:</b>	Unirac SFM

# POWERWALL

Tesla Powerwall is a fully-integrated AC battery system for residential or light commercial use. Its rechargeable lithium-ion battery pack provides energy storage for solar self-consumption, time-based control, and backup.

Powerwall's electrical interface provides a simple connection to any home or building. Its revolutionary compact design achieves market-leading energy density and is easy to install, enabling owners to quickly realize the benefits of reliable, clean power.



## PERFORMANCE SPECIFICATIONS

AC Voltage (Nominal)	120/240 V
Feed-In Type	Split Phase
Grid Frequency	60 Hz
Total Energy <sup>1</sup>	14 kWh
Usable Energy <sup>1</sup>	13.5 kWh
Real Power, max continuous <sup>2</sup>	5 kW (charge and discharge)
Real Power, peak (10s, off-grid/backup) <sup>2</sup>	7 kW (charge and discharge)
Apparent Power, max continuous	5.8 kVA (charge and discharge)
Apparent Power, peak (10s, off-grid/backup)	7.2 kVA (charge and discharge)
Maximum Supply Fault Current	10 kA
Maximum Output Fault Current	32 A
Overcurrent Protection Device	30 A
Imbalance for Split-Phase Loads	100%
Power Factor Output Range	+/- 1.0 adjustable
Power Factor Range (full-rated power)	+/- 0.85
Internal Battery DC Voltage	50 V
Round Trip Efficiency <sup>1,2</sup>	90%
Warranty	10 years

<sup>1</sup>Values provided for 25°C (77°F), 3.3 kW charge/discharge power.

<sup>2</sup>In Backup mode, grid charge power is limited to 3.3 kW.

<sup>3</sup>AC to battery to AC, at beginning of life.

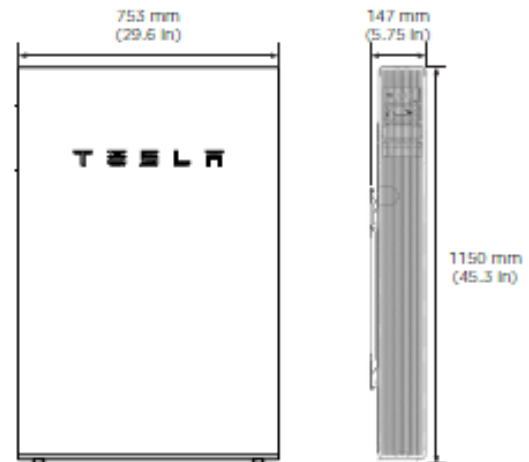
## COMPLIANCE INFORMATION

Certifications	UL 1642, UL 1741, UL 1973, UL 9540, IEEE 1547, UN 38.3
Grid Connection	Worldwide Compatibility
Emissions	FCC Part 15 Class B, ICES 003
Environmental	RoHS Directive 2011/65/EU
Seismic	AC156, IEEE 693-2005 (high)

## MECHANICAL SPECIFICATIONS

Dimensions <sup>1</sup>	1150 mm x 753 mm x 147 mm (45.3 in x 29.6 in x 5.75 in)
Weight <sup>1</sup>	114 kg (251.3 lbs)
Mounting options	Floor or wall mount

<sup>1</sup>Dimensions and weight differ slightly if manufactured before March 2019. Contact Tesla for additional information.



## ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	-20°C to 50°C (-4°F to 122°F)
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	NEMA 3R
Ingress Rating	IP67 (Battery & Power Electronics) IP56 (Wiring Compartment)
Wet Location Rating	Yes
Noise Level @ 1m	< 40 dBA at 30°C (86°F)

# 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

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 <sup>1</sup>
Overcurrent Protection Device	100-200A; Service Entrance Rated <sup>1</sup>
Overvoltage Category	Category IV
AC Meter	Revenue accurate (+/- 0.2 %)
Primary Connectivity	Ethernet, Wi-Fi
Secondary Connectivity	Cellular (3G, LTE/4G) <sup>2</sup>
User Interface	Tesla App
Operating Modes	Support for solar self-consumption, time-based control, backup, and off-grid
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

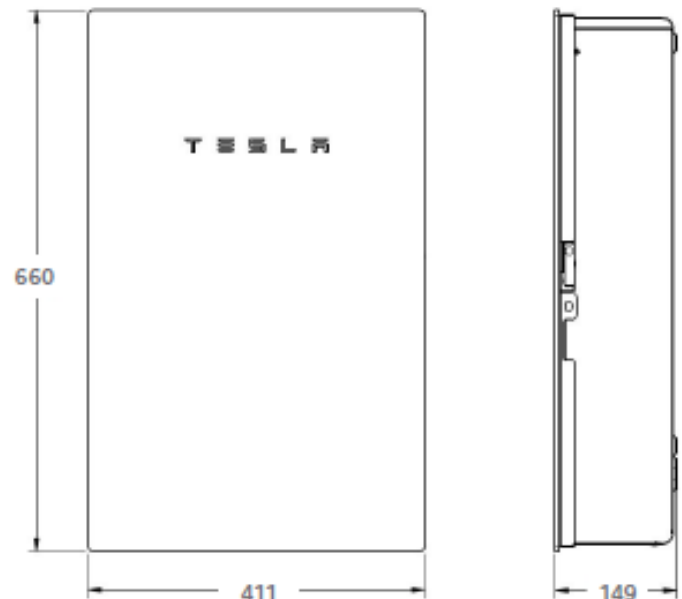
<sup>1</sup> When protected by Class J fuses, Backup Gateway 2 is suitable for use in circuits capable of delivering not more than 22kA symmetrical amperes.  
<sup>2</sup> The customer is expected to provide internet connectivity for Backup Gateway 2; cellular should not be used as the primary mode of 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

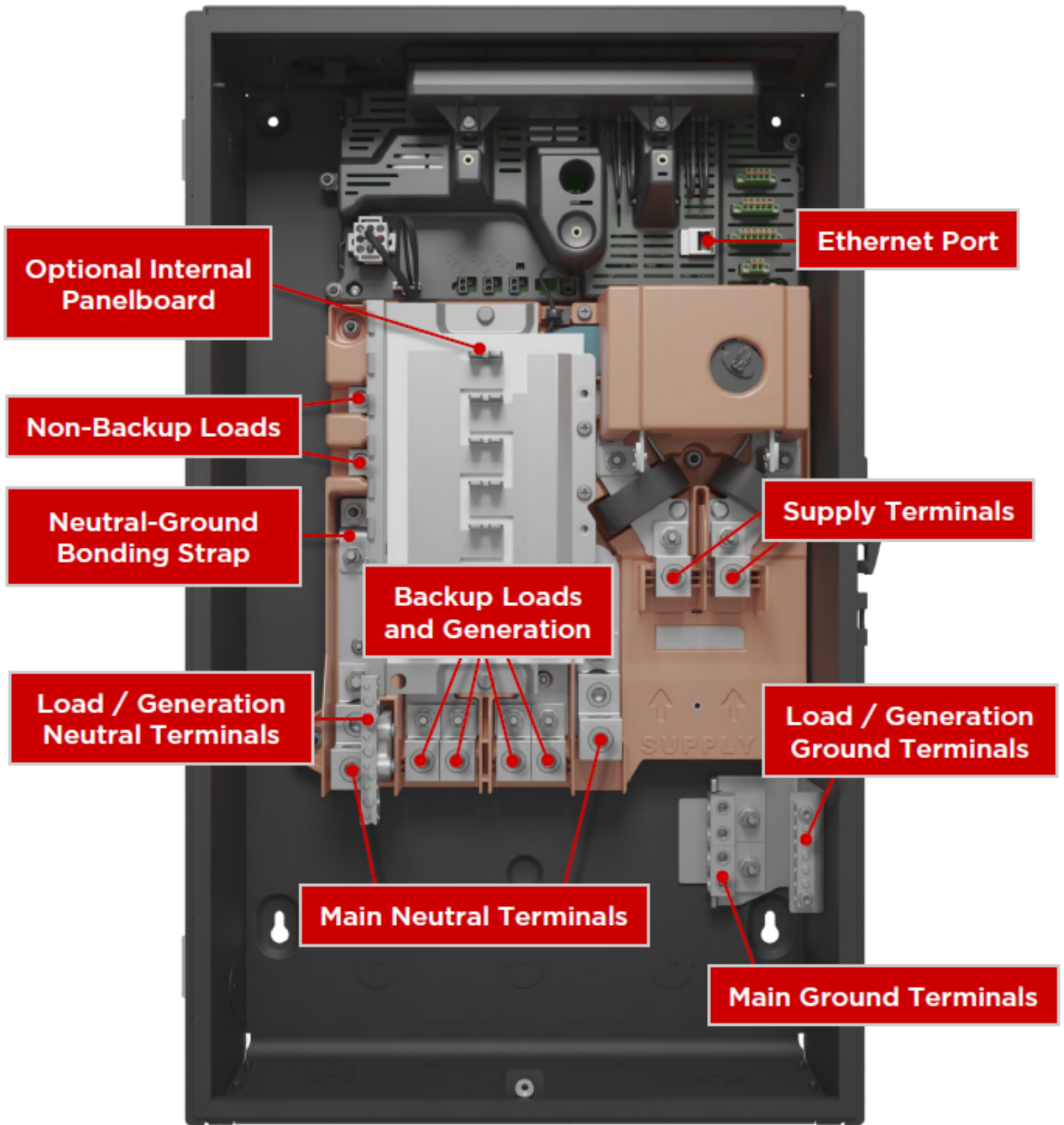
Dimensions	660 mm x 411 mm x 149 mm (26 in x 16 in x 6 in)
Weight	20.4 kg (45 lb)
Mounting options	Wall mount, Semi-flush mount



### 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

# BACKUP GATEWAY 2 OVERVIEW





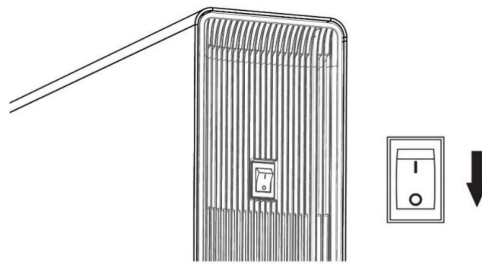


Topic: Powerwall disconnecting means to comply with 706.7 of the 2017 NEC or 2019 CEC

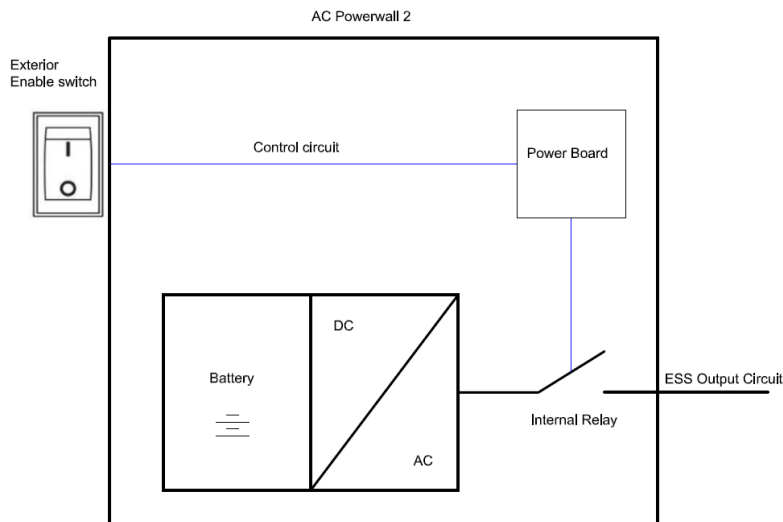
To whom it may concern,

This purpose of this letter is to clarify how the AC Powerwall 2 meets the requirements of 706.7 of the 2017 NEC or 2019 CEC for Disconnecting Means. (Note that 706.7 of the 2017 NEC is mostly equivalent to 690.71 H of the 2014 NEC though has minor differences. For jurisdictions on the 2016 CEC, the entirety of Article 706 from the 2017 NEC was incorporated into the 2016 CEC as part of the July 1<sup>st</sup> 2018 Supplement.)

Manufactured for all Powerwalls, on the side of the enclosure, is a small switch. This is referred to as the "Enable" switch per the AC Powerwall 2 Installation Manual. The switch acts as a control circuit for a 240V relay integrated into the Powerwall enclosure. This internal relay is connected to the Powerwall Energy Storage System output conductors, thus when the relay is opened, the Energy Storage System ungrounded conductors are isolated from all connected circuits (load, utility, or other generation sources).



A circuit diagram of this disconnecting means is show below:





Viewing this Enable switch and internal relay from a Code perspective, the first consideration is if it meets the Article 100 definition of a disconnecting means:

**Disconnecting Means.** A device, or **group of devices**, or other means by which the conductors of a circuit can be disconnected from their source of supply. (CMP-1)

**Device.** A unit of an electrical system, other than a conductor, that carries or controls electric energy as its principal function. (CMP-1)

The Enable switch and internal relay would meet the definitions for a 'group of devices,' thus, this can be considered a 'disconnecting means.'

Now that we have confirmed this is a disconnecting means, we can look at the relevant sections of **706.7 Disconnecting Means** to see if the Powerwall disconnecting means satisfies the requirements for an Energy Storage System disconnecting means:

**706.7 Disconnecting Means.**

**(A) ESS Disconnecting Means.** A disconnecting means shall be provided for all ungrounded conductors derived from an ESS. A disconnecting means shall be readily accessible and located within sight of the ESS.

The AC Powerwall 2 integrated disconnecting means does disconnect all ungrounded conductors at the ESS, is readily accessible to the ESS, and located within sight of the ESS. Therefore the Powerwall product is always compliant with 706.7 (A).

**(E) Partitions and Distance.** Where energy storage system input and output terminals are more than 1.5 m (5 ft) from connected equipment, or where the circuits from these terminals pass through a wall or partition, the installation shall comply with the following:

(1) A disconnecting means shall be provided at the energy storage system end of the circuit. Fused disconnecting means or circuit breakers shall be permitted to be used.

While 706.7 (E)(1) specifically mentions fuses and circuit breakers, it does not require their use. Any disconnecting means, as previously defined, are allowed. Therefore the Powerwall product on its own is always compliant with 706.7 (E)(1).

Other sections of 706.7 are either not applicable, or applicable to connected equipment and secondary disconnecting means, thus are not considered here.

In conclusion, based on how the AC Powerwall 2 is manufactured, the product will always meet the requirements of 706.7 for disconnecting means necessary at the Energy Storage System end of the circuit.

Sincerely,

[codecompliance@tesla.com](mailto:codecompliance@tesla.com)





July 30, 2020

Unirac  
1411 Broadway Blvd. NE  
Albuquerque, NM 87102

Attn.: Unirac - Engineering Department

Re: Engineering Certification for the Unirac Sunframe Microrail, SFM Infinity U-builder Software Version 1.0

PZSE, Inc. - Structural Engineers has reviewed the Unirac's Sunframe Microrail, proprietary mounting system constructed from modular parts which is intended for rooftop installation of solar photovoltaic (PV) panels; and has reviewed the U-builder Online tool. This U-Builder software includes analysis for the 2" Microrail, 8" Attached Splice, 6" splice, and front trimrail. All information, data and analysis contained within are based on, and comply with the following codes and typical specifications:

1. Minimum Design Loads for Buildings and other Structures, ASCE/SEI 7-05, ASCE/SEI 7-10, ASCE/SEI 7-16
2. 2006-2018 International Building Code, by International Code Council, Inc. w/ Provisions from SEAOC PV-2 2017.
3. 2006-2018 International Residential Code, by International Code Council, Inc. w/ Provisions from SEAOC PV-2 2017.
4. AC428, Acceptance Criteria for Modular Framing Systems Used to Support Photovoltaic (PV) Panels, November 1, 2012 by ICC-ES.

Following are typical specifications to meet the above code requirements:

- Design Criteria:** Ground Snow Load = 0 - 100 (psf)  
Basic Wind Speed = 90 - 180 (mph)  
Roof Mean Height = 0 - 30 (ft)  
Roof Pitch = 0 - 45 (degrees)  
Exposure Category = B, C & D
- Attachment Spacing:** Per U-builder Engineering report.
- Cantilever:** Per U-builder Engineering report.
- Clearance:** 2" to 10" clear from top of roof to top of PV panel.
- Tolerance(s):** 1.0" tolerance for any specified dimension in this report is allowed for installation.
- Installation Orientation:** See SFM Installation Guide.  
Landscape - PV Panel long dimension is parallel to ridge/eave line of roof and the PV panel is mounted on the long side.  
Portrait - PV Panel short dimension is parallel to ridge/eave line of roof and the PV panel is mounted on the short side.  
Attachment shall be staggered where ground snow load exceeds 10 PSF.

**Testing:** Values were based on UTR-299 testing provided by Unirac.

**Components and Cladding Roof Zones:**

The Components and Cladding Roof Zones shall be determined based on ASCE 7-05, ASCE 7-10 & 7-16 Component and Cladding design.

- Notes:
- 1) U-builder Online tool analysis is only for Unirac SFM Sunframe Microrail system only and do not include roof capacity check.
  - 2) Risk Category II per ASCE 7-16.
  - 3) Topographic factor,  $k_{zt}$  is 1.0.
  - 4) Array Edge Factor  $Y_E = 1.5$
  - 5) Average parapet height is 0.0 ft.
  - 6) Wind speeds are LRFD values.
  - 7) Attachment spacing(s) apply to a seismic design category E or less.

**Design Responsibility:**

The U-Builder design software is intended to be used under the responsible charge of a registered design professional where required by the authority having jurisdiction. In all cases, this U-builder software should be used under the direction of a design professional with sufficient structural engineering knowledge and experience to be able to:

- Evaluate whether the U-Builder Software is applicable to the project, and
- Understand and determine the appropriate values for all input parameters of the U-Builder software.

This letter certifies that the Unirac SFM Sunframe Microrail, when installed according to the U-Builder engineering report and the manufacture specifications, is in compliance with the above codes and loading criteria.

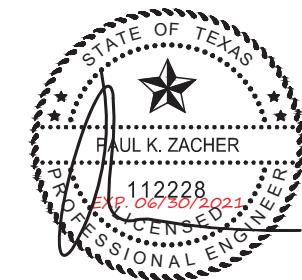
This certification excludes evaluation of the following components:

- 1) The structure to support the loads imposed on the building by the array; including, but not limited to: strength and deflection of structural framing members, fastening and/or strength of roofing materials, and/or the effects of snow accumulation on the structure.
- 2) The attachment of the SFM 2" Microrail or 8" Attached Splice to the existing structure.
- 3) The capacity of the solar module frame to resist the loads.

This requires additional knowledge of the building and is outside the scope of the certification of this racking system.

If you have any questions on the above, do not hesitate to call.

Prepared by:  
PZSE, Inc. – Structural Engineers  
Roseville, CA



F-15844

Subject: ETL Evaluation of SolarEdge Products to NEC 2017 Rapid Shutdown Requirements

To, whom it may concern

This letter represents the testing results of the below listed products to the requirements contained in the following standards:

National Electric Code, 2017, Section 690.12 requirement for rapid shutdown.

UL 1741, UL 1741 CRD for rapid shutdown

The evaluation was done on the PV Rapid Shutdown System (PVRSS), and covers installations consisting of optimizers and inverters with part numbers listed below.

The testing done has verified that controlled conductors are limited to:

- Not more than 30 volts and 240 voltamperes within 30 seconds of rapid shutdown initiation outside the array.
- Not more than 80 volts and 240 voltamperes within 30 seconds of rapid shutdown initiation inside the array.

The rapid shutdown initiation is performed by either disconnecting the AC feed to the inverter, or – if the inverter DC Safety switch is readily accessible – by turning off the DC Safety switch.

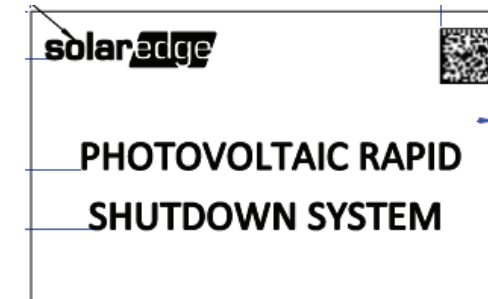
Applicable products:

- Power optimizers:
  - PB followed by 001 to 350; followed by -AOB or -TFI.
  - OP followed by 001 to 500; followed by -LV, -MV, -IV or -EV.
  - P followed by 001 to 850.
  - SP followed by 001 to 350.

\*When optimizers are connected to 2 or more modules in series, the max input voltage may exceed 80V. Following the implementation of the NEC 2017 rapid shutdown value of 80V max inside of the array at the beginning of 2019, modules exceeding this combined input max voltage will be required to use optimizers with parallel inputs.
- 1-ph Inverters:

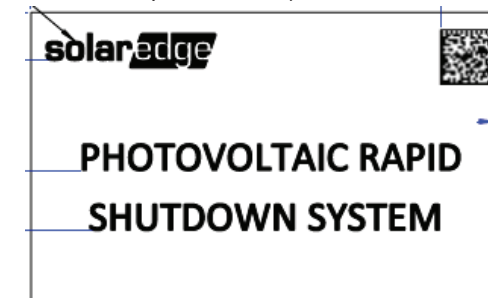
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- SE3000A-US / SE3800A-US / SE5000A-US / SE6000A-US / SE7600A-US / SE10000A-US / SE11400A-US / SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US when the following label is labeled on the side of the inverter:



Inverter part number may be followed by a suffix

- 3-ph Inverters:
  - SE9KUS / SE10KUS / SE14.4KUS / SE20KUS / SE30KUS / SE33.3KUS / SE43.2KUS / SE66.6KUS / SE100KUS ; when the following label is labeled on the side of the inverter:



Inverter part number may be followed by a suffix

If there are any questions regarding the results contained in this report, or any of the other services offered by Intertek, please do not hesitate to contact the undersigned.

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TÜV Rheinland PTL

# Certificate

Certificate no.

US 82160015 01

**License Holder:**

Unirac Inc.  
1411 Broadway NE  
Albuquerque NM 87102  
USA

**Manufacturing Plant:**

Unirac Inc.  
1411 Broadway NE  
Albuquerque NM 87102  
USA

**Test report no.:** USA- 31440029 005

**Client Reference:** Tom Young

**Tested to:** UL 2703:2015

**Certified Product:** Module Rack Mounting System

**License Fee - Units**

Model Designation: SolarMount (SM)

7

Max System Voltage of PV Module: 1000 VDC  
Max Size of PV Module: 20.8 sq.ft. surface area  
Max Overcurrent Protection Rating of PV Module:  
30 A when using the qualified grounding lugs;  
20 A when using the Enphase micro inverter EGC.

Fire Rating: Class A when installed with  
Type 1, Type 2, Type3, or Type 10 fire rated modules.

(continued)

Appendix: 1,1-5

7

**Licensed Test mark:**



**Date of Issue**

**(day/mo/yr)**

27/07/2016