

# PHOTOVOLTAIC ROOF MOUNT SYSTEM

1076 MODULES-ROOF MOUNTED - 484.2 KWDC, 400 KWAC

THE GREEN ON CAMPUS DRIVE

499 W 960 S ST, OREM, UT 84058

1. SOLAR CONTRACTOR
    - 1.1. THE SOLAR PV INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
    - 1.2. PV MODULE MUST BE UL1703 CERTIFIED.
    - 1.3. INVERTERS, MOTOR GENERATORS, PV MODULES, PV PANELS, AC MODULES, DC COMBINERS, DC-TO-DC CONVERTERS, AND CHARGE CONTROLLERS INTENDED FOR USE IN PV SYSTEMS SHALL BE LISTED OR FIELD LABELED FOR THE PV APPLICATION. (NEC 690.4(D))
    - 1.4. CONDUIT AND WIRE SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS.
    - 1.5. MAX DC VOLTAGE IS CALCULATED USING MANUFACTURER PROVIDED TEMP COEFFICIENT FOR VOC, UNLESS NOT AVAILABLE.
    - 1.6. ALL WIRING TO BE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE.
    - 1.7. CONDUIT POINT OF PENETRATION FROM EXTERIOR TO INTERIOR TO BE INSTALLED AND SEALED WITH A SUITABLE SEALING COMPOUND
  2. WIRING METHODS
    - 2.1. NONMETALLIC-SHEATHED CABLE SHALL BE SECURED BY STAPLES, CABLE TIES, STRAPS, HANGERS OR SIMILAR FITTINGS AT INTERVALS THAT DO NOT EXCEED 4.5 FEET. (NEC 334.30)
    - 2.2. CABLES SHALL BE SECURED WITHIN 12 INCHES OF EVERY CABLE ENTRY INTO ENCLOSURES SUCH AS OUTLET BOXES, JUNCTION BOXES, CABINETS, OR FITTINGS. (NEC 334.30)
    - 2.3. EXPOSED SINGLE CONDUCTORS, WHERE SUBJECT TO PHYSICAL DAMAGE, MUST BE PROTECTED. (NEC 300.4 & NEC 690.31(A))
    - 2.4. CONDUCTORS INSTALLED NEAR MODULES SHALL BE RATED FOR 90°C. (NEC 310.15(A)(3))
    - 2.5. CONDUCTORS SHOULD NOT BE IN CONTACT WITH THE ROOF SURFACE.
    - 2.6. PV CIRCUIT AND PREMISES WIRING SHALL BE SEPARATED.
    - 2.7. PV SYSTEM CONDUCTORS SHALL BE IDENTIFIED AND GROUPED PER NEC 690.31(B).
    - 2.8. DC CONDUCTORS INSIDE A BUILDING SHALL BE IN A METAL RACEWAY OR MC METAL-CLAD CABLE THAT COMPLIES WITH 250.138(I)(1), OR METAL ENCLOSURES. (NEC 690.31(G))
    - 2.9. WHERE RACEWAYS OR CABLES ARE EXPOSED TO DIRECT SUNLIGHT ON OR ABOVE ROOFTOPS, RACEWAYS OR CABLES SHALL BE AT MINIMUM HEIGHT OF 7/8 IN. (NEC 310.15(B)(3)(C))
    - 2.10. ALL CONDUIT SIZES AND TYPES, SHALL BE LISTED FOR ITS PURPOSE AND APPROVED FOR THE SITE APPLICATIONS.
    - 2.11. RIGID CONDUIT (AND/OR NIPPLES) MUST HAVE A PULL BUSHING TO PROTECT WIRES.
    - 2.12. FOR DC SINGLE-CONDUCTOR CABLE TYPE USE-2 AND SINGLE CONDUCTOR CABLE LISTED AND IDENTIFIED AS PHOTOVOLTAIC (PV) WIRE SHALL BE PERMITTED IN EXPOSED OUTDOOR LOCATIONS IN PV SOURCE CIRCUITS WITHIN THE PV ARRAY. PV WIRE SHALL BE INSTALLED IN ACCORDANCE WITH 338.10(B)(4)(B) AND 334.30. (NEC 690.31(C)(1))
    - 2.13. USE-2 IS NOT INDOOR RATED PER NEC 338.12(B)(1).
    - 2.14. ALL CONDUCTORS ARE SIZED PER NEC 690.8 AND OCPDs ARE SIZED PER 690.9.
    - 2.15. PV SYSTEM DC CIRCUIT AND INVERTER OUTPUT CONDUCTORS AND EQUIPMENT SHALL BE PROTECTED AGAINST OVERCURRENT. EXCEPT WHEN THE SHORT-CIRCUIT CURRENTS FROM ALL SOURCES DO NOT EXCEED THE AMPLITUDE OF THE CONDUCTORS AND THE MAXIMUM OCPD SIZE RATING SPECIFIED FOR THE PV MODULE OR DC-TO-DC CONVERTER. (NEC 690.9(A))
    - 2.16. FOR UNDERGROUND CONDUCTOR INSTALLATIONS, THE BURIAL DEPTH SHALL BE SELECTED PER NEC TABLE 300.5. WARNING TAPE SHALL BE PLACED ABOVE UNDERGROUND CONDUIT AND CONDUCTORS IN TRENCH.
    - 2.17. UNGROUNDED PV SYSTEM SHOULD NOT HAVE WHITE OR GRAY COLORED DC PV CONDUCTORS. ONLY SOLIDLY GROUNDED PV SYSTEM CIRCUIT CONDUCTORS, IN ACCORDANCE WITH 690.41(A)(5), SHALL BE MARKED IN ACCORDANCE WITH 200.6. (NEC 690.31(B)(1))
    - 2.18. ALUMINUM AND COPPER-CLAD ALUMINUM CONDUCTORS SHOULD NOT BE PLACED IN DIRECT CONTACT WITH CONCRETE OR EARTH. (NEC 250.120(B))
    - 2.19. TOP CONDUIT ENTRY FOR OUTDOOR ENCLOSURES MUST BE AVOIDED. IF NECESSARY, CONNECTION ABOVE LIVE PARTS MUST BE MADE WATERTIGHT AND BE LISTED FOR THE PURPOSE.
  3. BONDING AND GROUNDING
    - 3.1. SYSTEMS WITH A GROUND-FAULT PROTECTIVE DEVICE IN ACCORDANCE WITH 690.4(B) SHALL HAVE ANY CURRENT-CARRYING CONDUCTOR TO GROUND CONNECTION MADE BY THE GROUND-FAULT PROTECTIVE DEVICE. FOR SOLIDLY GROUNDED PV SYSTEMS, THE DC CIRCUIT GROUNDING CONNECTION SHALL BE MADE AT ANY SINGLE POINT ON THE PV OUTPUT CIRCUIT. (NEC 690.42)
    - 3.2. RACKING SYSTEMS SHALL BE LISTED FOR THE PURPOSE. BONDING AND GROUNDING MUST BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS, THAT ARE LISTED AND APPROVED, USING THE SUPPLIED HARDWARE OR LISTED EQUIPMENT SPECIFIED IN THE INSTRUCTIONS AND IDENTIFIED FOR THE ENVIRONMENT. (NEC 690.43 & 110.31(B))
    - 3.3. EQUIPMENT GROUNDING CONDUCTORS FOR PV SOURCE CIRCUITS SHALL BE SIZED ACCORDING TO TABLE 250.122 AND SHALL NOT BE SMALLER THAN #14 AWG WHEN NOT EXPOSED TO PHYSICAL DAMAGE. IF EXPOSED TO PHYSICAL DAMAGE THEN EGC SHALL NOT BE SMALLER THAN #6 AWG. (NEC 690.45 & 250.120(C))
    - 3.4. AC AND DC GROUNDING ELECTRODE CONDUCTORS SHALL BE PROPERLY CONNECTED AS REQUIRED BY CODE. SEPARATE ELECTRODES, IF USED, SHALL BE BONDED TOGETHER. (NEC 690.47, 250.50 & 250.58)
    - 3.5. A GROUNDING ELECTRODE SYSTEM IN ACCORDANCE WITH NEC 690.47, NEC 250.52 AND NEC 250.166 SHALL BE PROVIDED.
    - 3.6. PROPERLY SIZED EQUIPMENT GROUNDING CONDUCTOR SHALL BE ROUTED WITH THE CIRCUIT CONDUCTORS. (NEC 690.45, 250.134(B) & 300.30(I))
    - 3.7. THE GROUNDING ELECTRODE CONDUCTOR SHALL BE PROTECTED FROM PHYSICAL DAMAGE BETWEEN THE GROUNDING ELECTRODE AND THE PANEL (OR INVERTER) IF SMALLER THAN #6 AWG COPPER WIRE PER NEC 250.64B.
    - 3.8. THE GROUNDING ELECTRODE CONDUCTOR SHALL BE CONTINUOUS PER NEC 250.64C.
    - 3.9. BONDING FITTINGS SHALL BE USED ON CONCENTRIC/ECCENTRIC KNOCKOUTS WITH METAL CONDUITS FOR CIRCUITS OVER 250 VOLTS. (NEC 250.97) (SEE ALSO EXCEPTIONS 1 THROUGH 4)
    - 3.10. BONDING FITTINGS SHALL BE USED FOR FERROUS METAL CONDUITS ENCLOSING GROUNDING ELECTRODE CONDUCTORS. (NEC 250.64(E))
    - 3.11. ENCLOSURES SHALL BE PROPERLY PREPARED WITH REMOVAL OF PAINT/FINISH AS APPROPRIATE WHEN GROUNDING EQUIPMENT WITH TERMINATION GROUNDING LUGS.
    - 3.12. GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THE PURPOSE, AND GROUNDING DEVICES EXPOSED TO THE ELEMENTS SHALL BE RATED FOR DIRECT BURIAL.
    - 3.13. ALL CONDUIT BETWEEN THE UTILITY AC DISCONNECT AND THE POINT OF CONNECTION SHALL HAVE GROUNDED BUSHINGS AT BOTH ENDS.
    - 3.14. EXPOSED NON-CURRENT CARRYING METAL PARTS OF MODULE FRAMES, EQUIPMENTS, AND CONDUCTOR ENCLOSURES SHALL BE GROUNDED IN ACCORDANCE WITH 250.134 OR 250.136(A) REGARDLESS OF VOLTAGE. (NEC 690.43)
    - 3.15. MODULES SHALL BE LISTED FOR THE PURPOSE. BONDING AND GROUNDING MUST BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS, USING THE SUPPLIED HARDWARE OR LISTED EQUIPMENT SPECIFIED IN THE INSTRUCTIONS AND IDENTIFIED FOR THE ENVIRONMENT. (NEC 690.43 & 110.31(B))
    - 3.16. THE GROUNDING CONNECTION TO A MODULE SHALL BE ARRANGED SUCH THAT THE REMOVAL OF A MODULE DOES NOT INTERRUPT A GROUNDED CONDUCTOR TO ANOTHER MODULE.
- 705.12 POINT OF INTERCONNECTION  
(B) LOAD SIDE
- (1) DEDICATED OVERCURRENT AND DISCONNECT. EACH SOURCE INTERCONNECTION OF ONE OR MORE POWER SOURCES INSTALLED IN ONE SYSTEM SHALL HAVE ONLY ONE DEDICATED CIRCUIT BREAKER OR FUSIBLE DISCONNECTING MEANS WHICH CAN DISCONNECT ENTIRE SYSTEM.
  - (2) BUS OR CONDUCTOR AMPERE RATING.
    - a. 120% RULE  
THIS METHOD CAN ONLY BE USED WHERE A SERVICE MAIN BREAKER IS AT ONE END OF THE BUSBAR AND THE PV BREAKER IS AT THE OTHER END. 125% OF THE INVERTER OUTPUT CIRCUIT CURRENT EXCEEDS THE RATING OF THE OCPD PROTECTING THE BUSBAR CANNOT BE GREATER THAN 120% OF THE AMPACITY OF THE BUSBAR.  
PV OCPD = MAIN BREAKER x BUSBAR RATING X 1.2  
A PERMANENT WARNING LABEL, COMPLYING WITH 110.21(B), MUST BE APPLIED TO THE DISTRIBUTION EQUIPMENT ADJACENT TO THE BACK-FED BREAKER.

### GENERAL NOTES FOR LABELS AND MARKINGS:

1. Labels and markings shall be applied to the appropriate components in accordance with the NEC.
2. Solar modules are supplied from the manufacturer with markings pre-applied to meet the requirements of the NEC.
3. The inverter is supplied from the manufacturer with the appropriate labels and markings to meet the requirements of NEC.
4. All other warning and caution labels, unless otherwise specified, must meet the requirements of ANSI Z535.4 - 2011 per Article 110.21(B) in the NEC 2014. The ANSI standard requires that Danger, Warning, and Caution signs used the standard header colors, header text, and safety alert symbol on each label. The ANSI standard requires a heading that is at least 50% taller than the body. While not required in the NEC 2014, the message text should be at least 12" tall. If we compare this to Occupational Safety and Health Administration (OSHA) 1910.145 and the American National Standard Institute (ANSI) Z535, it is specified that signs must be visible at a safe viewing distance from the hazard. They also recommend the use of safety alert symbols, where applicable.

### LABELING REQUIREMENTS FOR ARTICLE 690

#### NEC 690.13(B)

Each photovoltaic system disconnecting means shall be permanently marked to identify it as a photovoltaic system disconnect.

#### NEC 690.15, IFC 605.11.1 & IFC 605.11.1.4

If the equipment is energized from more than one source, the disconnecting means must be grouped and identified.

#### NEC 690.16(B)

Non-load break rated disconnect means shall be marked.

#### NEC 690.17(E)

Where all terminals of the disconnecting means may be energized in the open position, a warning label shall be mounted on or adjacent to the disconnecting means.

#### NEC 690.31(B), IFC 605.11.1.2

Identification and Grouping Photovoltaic system conductors shall be identified and grouped. The means of identification shall be permitted by separate color coding, marking tape, tagging or other approved means.

#### NEC 690.31(E)(3), IFC 605.11.1.2

Labels shall appear at every section of the wiring system that is separated by enclosures, walls, partitions, ceilings or floors. Spacing between labels not to exceed 10 feet (3M).

#### NEC 690.33(E)(2)

Interruption current - be a type that requires the use of a tool to open will be marked " Do Not Disconnect under Load " .

#### NEC 690.35(F)

A PV power source shall be labeled at each junction box, combiner box or disconnect, and device where energized, ungrounded circuits may be exposed during service.

#### NEC 690.4(F)

Where circuits are embedded in buildup, laminate or membrane roofing materials not covered by PV modules and associated equipment, the location of the circuits shall be clearly marked.

#### NEC 690.4(G)

Bipolar photovoltaic systems shall be clearly marked with a permanent, legible warning notice indicating that the disconnection of the grounded conductor(s) may result in overvoltage on the equipment.

#### NEC 690.5(C)

A label shall appear on the utility interactive inverter or be applied by the installer near the ground fault indicator at a visible location.

#### NEC 690.52

AC modules shall be marked with identification terminals or leads with the ratings as shown on the label.

#### NEC 690.53

A permanent label for the direct-current PV power source shall be provided by the installer at the PV disconnecting means.

#### NEC 690.54

All interactive system points of interconnection with other sources shall be marked at an accessible location at the disconnecting means as the power source and with the rated AC output current and the nominal operating AC voltage.

#### NEC 690.55

PV power systems employing energy storage shall also be marked with the maximum operating voltage, including any equalization voltage and polarity of the grounded circuit conductor.

#### NEC 690.56(C)

Each Rapid Shutdown Switch shall be permanently marked to identify it as a Photovoltaic Rapid Shutdown. The sign or placard shall be marked as "PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN" using white letters that are 3/8" tall on a red background and shall be reflective.

### ADHESIVE FASTENED SIGNS

1. Labels and markings shall be applied to the appropriate components in accordance with the NEC.
2. Solar modules are supplied from the manufacturer with markings pre-applied to meet the requirements of the NEC.
3. The inverter is supplied from the manufacturer with the appropriate labels and markings to meet the requirements of NEC.
4. All other warning and caution labels, unless otherwise specified, must meet the requirements of ANSI Z535.4 - 2011 per Article 110.21(B) in the NEC 2014. The ANSI standard requires that Danger, Warning, and Caution signs used the standard header colors, header text, and safety alert symbol on each label. The ANSI standard requires a heading that is at least 50% taller than the body. While not required in the NEC 2014, the message text should be at least 12" tall. If we compare this to Occupational Safety and Health Administration (OSHA) 1910.145 and the American National Standard Institute (ANSI) Z535, it is specified that signs must be visible at a safe viewing distance from the hazard. They also recommend the use of safety alert symbols, where applicable.

#### NEC 110.21(B)(5)

ANSI Z535.4 - 2011 Product safety signs and labels, provides guidelines for the design and durability of safety signs and labels for application to electrical equipment.

#### NEC 110.21

The label shall be suitable for the environment where it is installed.

#### NEC 110.21(B) FIELD MARKING

Where required elsewhere in this code any field applied labels, warning(s) and markings shall comply with ANSI Z535.4

#### IFC 605.11.1.3

Adhesive fastened signs may be acceptable if properly adhered. Vinyl signs shall be weather resistant.

#### REQUIREMENTS FOR ELECTRICAL INSTALLATIONS (FIELD MARKING)

#### NEC 110.16

Electrical equipment that are in other than dwelling units shall be field marked to warn qualified persons of a potential Arc Flash hazard.

#### NEC 110.24(A)

Service equipment in other than dwelling units shall be legibly field marked with the available fault current.

#### NEC 110.27(C)

Entrances to rooms or other guarded locations that contain exposed live parts shall be marked with conspicuous warning signs forbidding unqualified persons to enter.

#### NEC 210.5(C)(1)(B)

Branch Circuits: The identification methods used for conductors originating within each branch circuit shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or distribution equipment.

#### NEC 230.3(E)

Where a building or structure is supported by more than one service, add a plaque to denote all other services.

#### NEC 408.4(B)

All switchboards and panelboards supplied by a feeder in other than one or two family dwellings shall be marked to indicate the device or equipment where the power supply(s) originates.

#### NEC 705.12(D)(4)

Equipment containing overcurrent devices in circuits supplying power to a busbar or conductor supplied from multiple sources shall be marked to indicate the presence of all sources.

#### NFPA 2018 130.(C)

Same as NEC 110.16 but includes additional label information that is required after 9/30/2011. Check latest 2018 NFPA Arc Flash requirements.

| SCOPE OF WORK: |                                       |
|----------------|---------------------------------------|
| PANEL MODEL    | SERAPHIM SEG-450-BMA-HV (450W)        |
| PANEL COUNT    | 1076                                  |
| INVERTER MODEL | SOLAREEDGE SE50KUS (50KW) (208/120V), |
| INVERTER COUNT | 08                                    |
| MOUNTING TYPE  | ROOF MOUNT                            |
| RACKING        |                                       |

| APPLICABLE CODES & STANDARDS |                          |
|------------------------------|--------------------------|
| BUILDING                     | 2015 IBC WITH AMENDMENTS |
| ELECTRICAL                   | NFPA 70, 2014            |
| FIRE                         | 2018 IFC WITH AMENDMENTS |
| CONSTRUCTION TYPE            | COMMERCIAL               |
| SYSTEM SIZE, KWSTC           | 484.2                    |
| SYSTEM SIZE, KWAC            | 400                      |
| ASHRAE STATION               | PROVO MUNI (AWOS)        |

|            |  |
|------------|--|
| CONTRACTOR |  |
| NAME       |  |
| ADDRESS    |  |

|                     |  |
|---------------------|--|
| ELECTRICAL ENGINEER |  |
| NAME                |  |
| ADDRESS             |  |

|              |                                |
|--------------|--------------------------------|
| PROJECT NAME | THE GREEN ON CAMPUS DRIVE      |
| ADDRESS      | 499 W 960 S ST, OREM, UT 84058 |

### CONTENT:

| SHEET NO. | SHEET NAME                       |
|-----------|----------------------------------|
| 001       | COVER SHEET                      |
| A-1.1     | SITE PLAN                        |
| A-1.2     | ARRAY PLAN                       |
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| E-2.2     | SINGLE LINE DIAGRAM-2 BUILDING 2 |
| E-2.3     | SINGLE LINE DIAGRAM-3 BUILDING 2 |
| E-2.4     | SINGLE LINE DIAGRAM-4 BUILDING 3 |
| E-2.5     | SINGLE LINE DIAGRAM-5 BUILDING 5 |
| E-2.6     | WIRING CALCULATIONS              |
| E-3.1     | EQUIPMENT ELEVATION-1 BUILDING 1 |
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| E-3.5     | EQUIPMENT ELEVATION-5 BUILDING 5 |
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| E-5       | LABELS AND MARKINGS              |
| E-6       | ELECTRICAL SPECS                 |
| S-1       | STRUCTURE DETAILS                |
| S-2       | STRUCTURAL SPECS                 |

JOB ID:

| REVISIONS |               |          |
|-----------|---------------|----------|
| NO.       | ISSUE         | DATE     |
| 01        | PRELIM DESIGN | 07-26-23 |
|           |               |          |
|           |               |          |
|           |               |          |

NEW PV SYSTEM  
484.2 kWp, 400 KWAC

THE GREEN ON  
CAMPUS DRIVE

499 W 960 S ST,  
OREM, UT 84058

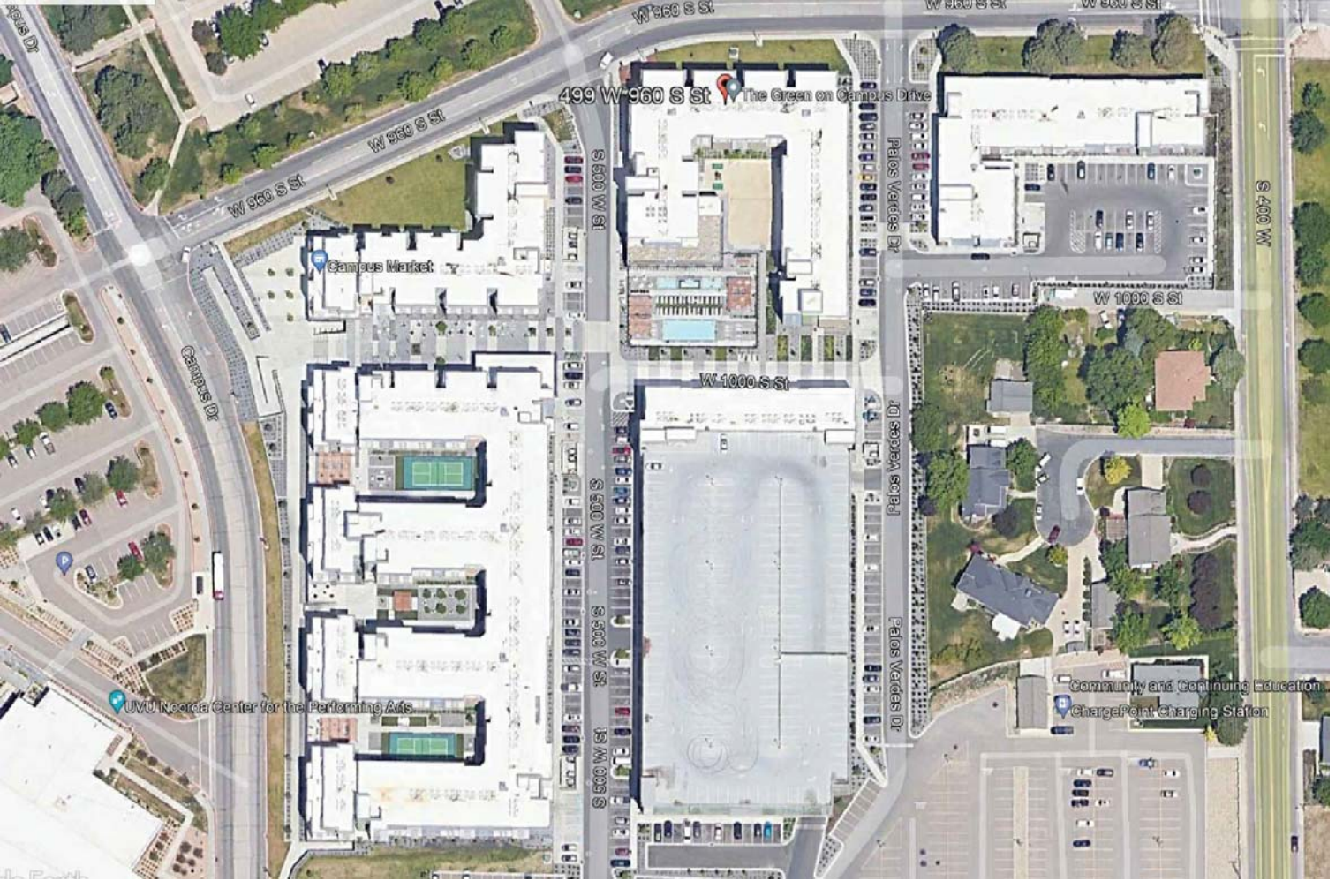
ENGINEER OF RECORD

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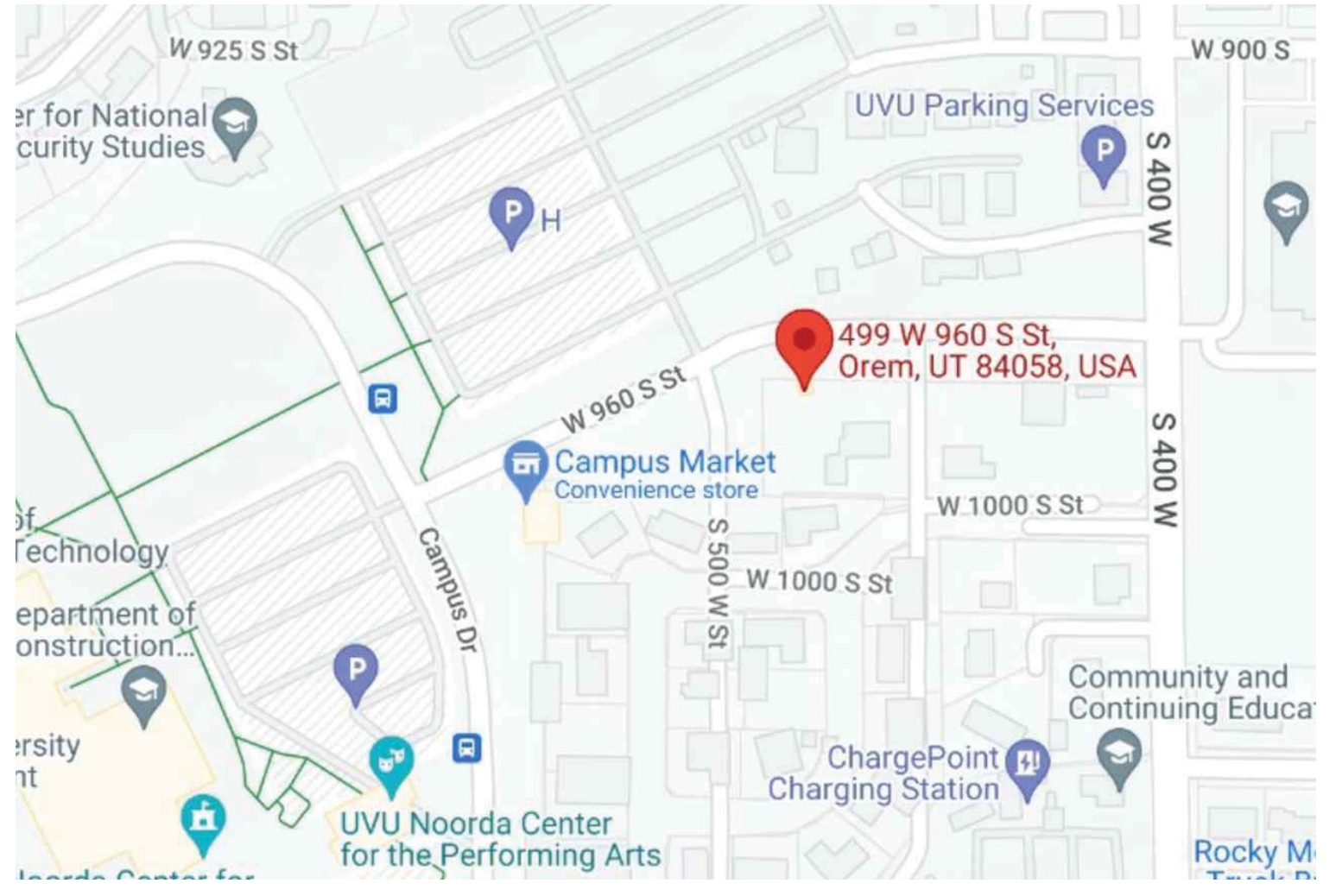
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SHEET TITLE:  
COVER SHEET

SHEET #:  
001



SYSTEM MAP



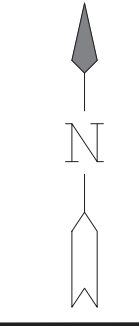
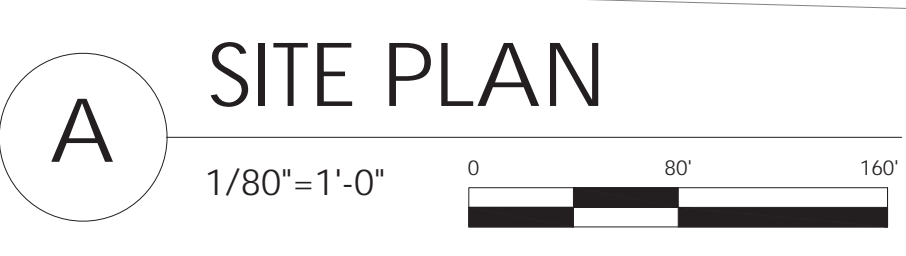
VICINITY MAP



SYSTEM SUMMARY  
 1076 SERAPHIM SEG-450-BMA-HV (450W) MODULES  
 08 SOLAREEDGE SE50KUS (50KW) (208/120V) INVERTER  
 SYSTEM SIZE: 484.2 KWDC 400 KWAC



NOTE:  
 MEASUREMENTS ARE APPROXIMATE & SHALL BE VERIFIED ON  
 FIELD.



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ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)

DESIGNED BY: AB

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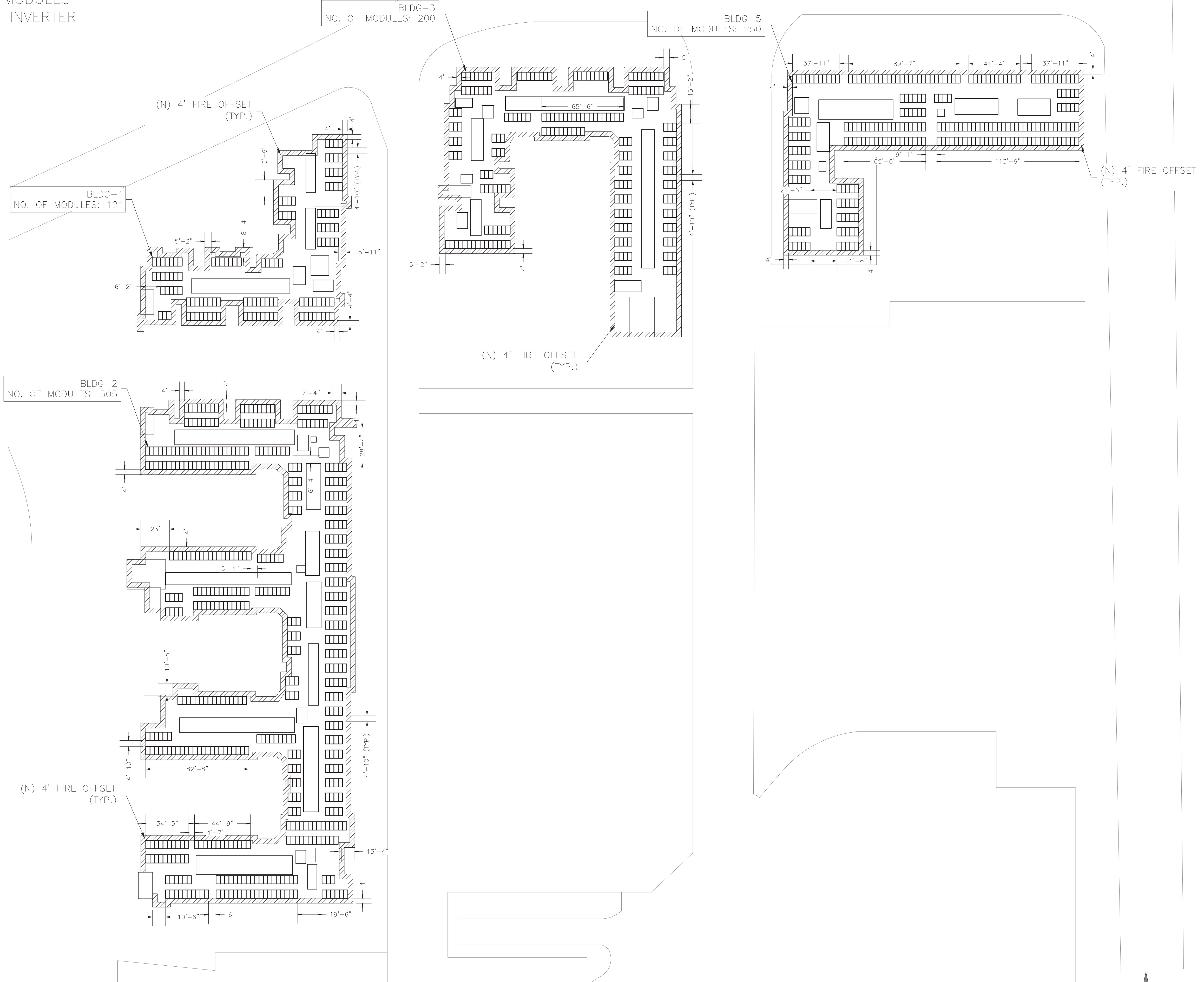
SHEET TITLE:  
 SITE PLAN

SHEET #:  
 A-1.1

SYSTEM SUMMARY

1076 SERAPHIM SEG-450-BMA-HV (450W) MODULES  
 08 SOLAREEDGE SE50KUS (50KW) (208/120V) INVERTER

SYSTEM SIZE: 484.2 KWDC 400 KWAC



NOTE:  
 MEASUREMENTS ARE APPROXIMATE & SHALL BE VERIFIED  
 ON FIELD.

**A** ARRAY PLAN

1/40"=1'-0" 0 40' 80'



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PAPER SIZE: 36" x 24" (ARCH D)

DESIGNED BY: AB

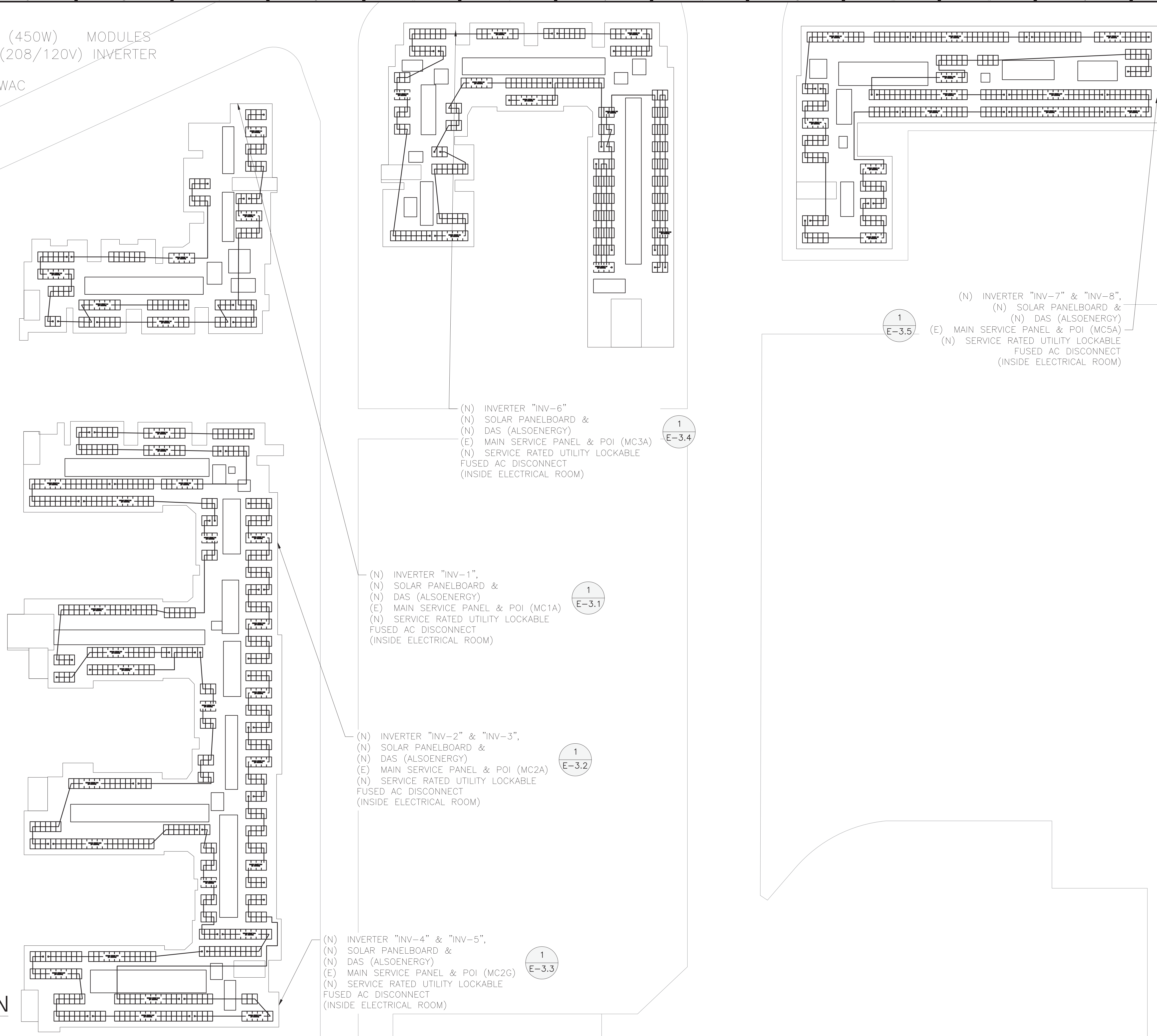
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SCALE:  
 1"=40'-0"

SHEET TITLE:  
 ARRAY PLAN

SHEET #:  
 A-1.2

SYSTEM SUMMARY  
 1076 SERAPHIM SEG-450-BMA-HV (450W) MODULES  
 08 SOLAREEDGE SE50KUS (50KW) (208/120V) INVERTER  
 SYSTEM SIZE: 484.2 KWDC 400 KWAC



1  
E-3.5  
 (N) INVERTER "INV-7" & "INV-8",  
 (N) SOLAR PANELBOARD &  
 (N) DAS (ALSOENERGY)  
 (E) MAIN SERVICE PANEL & POI (MC5A)  
 (N) SERVICE RATED UTILITY LOCKABLE  
 FUSED AC DISCONNECT  
 (INSIDE ELECTRICAL ROOM)

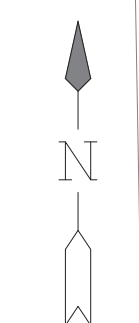
1  
E-3.4  
 (N) INVERTER "INV-6"  
 (N) SOLAR PANELBOARD &  
 (N) DAS (ALSOENERGY)  
 (E) MAIN SERVICE PANEL & POI (MC3A)  
 (N) SERVICE RATED UTILITY LOCKABLE  
 FUSED AC DISCONNECT  
 (INSIDE ELECTRICAL ROOM)

1  
E-3.1  
 (N) INVERTER "INV-1",  
 (N) SOLAR PANELBOARD &  
 (N) DAS (ALSOENERGY)  
 (E) MAIN SERVICE PANEL & POI (MC1A)  
 (N) SERVICE RATED UTILITY LOCKABLE  
 FUSED AC DISCONNECT  
 (INSIDE ELECTRICAL ROOM)

1  
E-3.2  
 (N) INVERTER "INV-2" & "INV-3",  
 (N) SOLAR PANELBOARD &  
 (N) DAS (ALSOENERGY)  
 (E) MAIN SERVICE PANEL & POI (MC2A)  
 (N) SERVICE RATED UTILITY LOCKABLE  
 FUSED AC DISCONNECT  
 (INSIDE ELECTRICAL ROOM)

1  
E-3.3  
 (N) INVERTER "INV-4" & "INV-5",  
 (N) SOLAR PANELBOARD &  
 (N) DAS (ALSOENERGY)  
 (E) MAIN SERVICE PANEL & POI (MC2G)  
 (N) SERVICE RATED UTILITY LOCKABLE  
 FUSED AC DISCONNECT  
 (INSIDE ELECTRICAL ROOM)

**A** ELECTRICAL SITE PLAN  
 1/32"=1'-0"  
 0 32' 64'



JOB ID:

| REVISIONS |               |          |
|-----------|---------------|----------|
| NO.       | ISSUE         | DATE     |
| 01        | PRELIM DESIGN | 07-26-23 |
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NEW PV SYSTEM  
 484.2 kWp, 400 KWAC  
 THE GREEN ON  
 CAMPUS DRIVE

499 W 960 S ST,  
 OREM, UT 84058

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (A0/12)  
 DESIGNED BY: AB  
 CHECKED BY: AB

SCALE:  
 1"= 32'-0"

SHEET TITLE:  
 STRINGING PLAN

SHEET #:  
 E-1

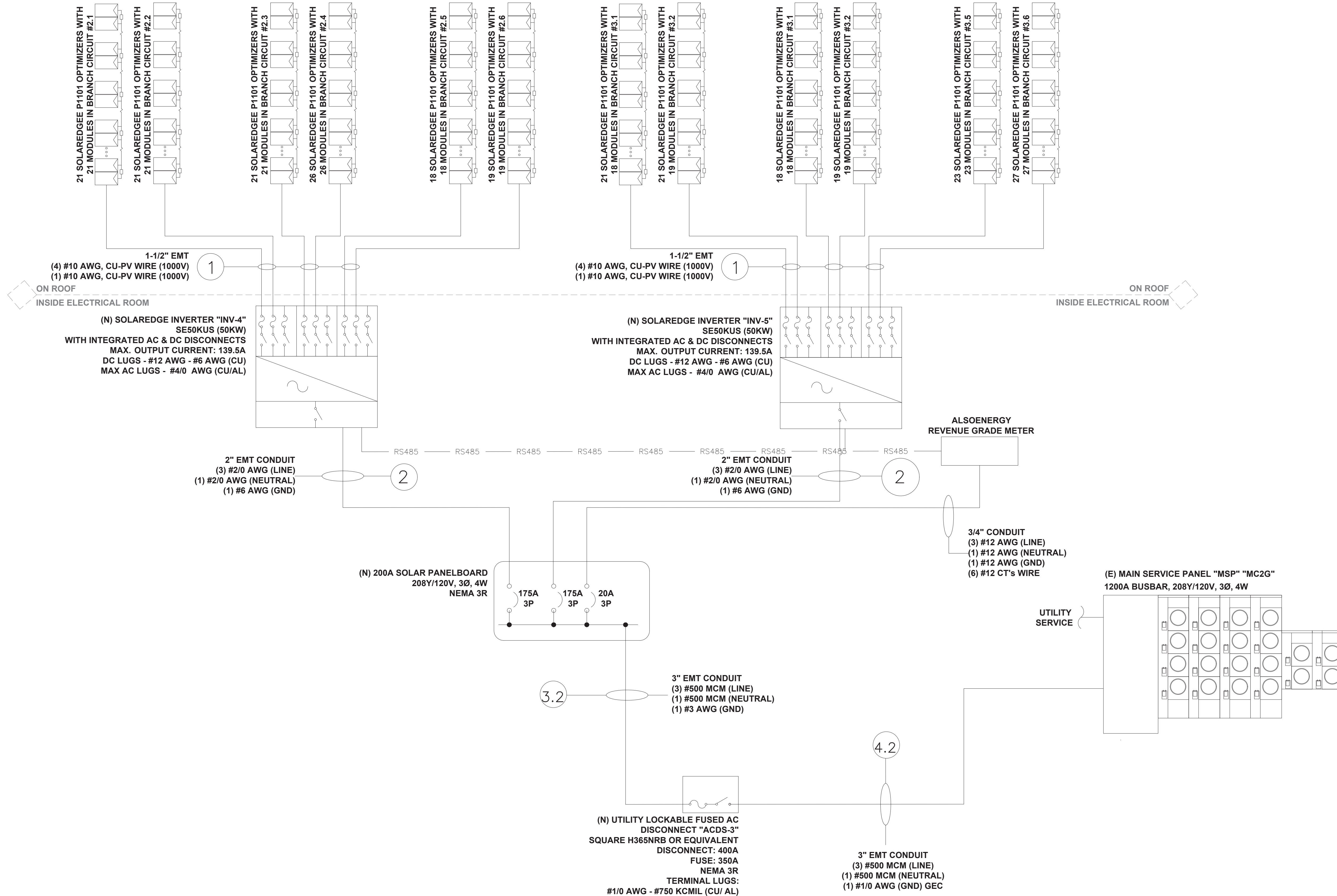
**NOTES:**

- IF THE SERVICE RATED UTILITY LOCKABLE DISCONNECT IS MORE THAN 10 FEET FROM THE POINT OF INTERCONNECT, CABLE LIMITERS MUST BE USED.

**SYSTEM SIZE: 112.5 KWSTC; 100KWAC**

**INVERTERS:**  
 (02) SOLAREEDGE SE20KUS (50KW) (208Y/120V)  
 MODULE: (250) SERAPHIM SEG-450-BMA-HV (450W)  
 OPTIMIZERS: (250) SOLAREEDGE P1101  
 2 STRING OF 18 MODULES  
 STRING ISC 11.41A, STRING VOC 901.8V  
 2 STRING OF 19 MODULES  
 STRING ISC 11.41A, STRING VOC 951.9V

5 STRINGS OF 21 MODULES  
 STRING ISC 11.41A, STRING VOC 1052.1V  
 1 STRINGS OF 23 MODULES  
 STRING ISC 11.41A, STRING VOC 1152.3V  
 1 STRINGS OF 26 MODULES  
 STRING ISC 11.41A, STRING VOC 1302.6V  
 1 STRINGS OF 27 MODULES  
 STRING ISC 11.41A, STRING VOC 1352.7V



JOB ID:

| REVISIONS |               |          |
|-----------|---------------|----------|
| NO.       | ISSUE         | DATE     |
| 01        | PRELIM DESIGN | 07-26-23 |
|           |               |          |
|           |               |          |
|           |               |          |

NEW PV SYSTEM  
 484.2 kWp, 400 KWAC

THE GREEN ON  
 CAMPUS DRIVE

499 W 960 S ST,  
 OREM, UT 84058

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)

DESIGNED BY: AB

CHECKED BY: AB

SCALE:  
 NTS

SHEET TITLE:  
 SINGLE LINE  
 DIAGRAM-3  
 BUILDING 2

SHEET #:  
 E-2.3

NOTES:  
 1. CONDUIT TO BE MIN. 7/8" ABOVE ROOF SURFACE.  
 2. CONDUIT FILL CALCULATED PER NEC CHAPTER 9 TABLE 1.

FEEDER CALCULATIONS

| WIRE TAG | FED FROM         | EQUIPMENT SUPPLIED | VOLTAGE | FULL LOAD AMPS 'FLA' | FLA X 1.25 OR 1.56 | OCPD SIZE | GROUND SIZE | CONDUCTOR PER PHASE | PHASE CONDUCTOR SIZE | NEUTRAL CONDUCTOR SIZE | 75° AMPACITY | 90° AMPACITY | 90° AMPACITY WITH C.O.U | C.O.U DERATE AMBIENT TEMP | C.O.U DERATE CONDUIT FILL |
|----------|------------------|--------------------|---------|----------------------|--------------------|-----------|-------------|---------------------|----------------------|------------------------|--------------|--------------|-------------------------|---------------------------|---------------------------|
| 1        | STRINGS          | INVERTER           | 1000V   | 11.41                | 14.26              | N/A       | #10         | 1                   | #10                  | N/A                    | 35           | 40           | 30.72                   | 0.96                      | 0.8                       |
| 2        | INVERTER         | SOLAR PANELBOARD   | 480     | 139.5                | 174.38             | 175       | #6          | 1                   | #2/0                 | #2/0                   | 175          | 195          | 187.2                   | 0.96                      | 1                         |
| 3.1      | SOLAR PANELBOARD | ACDS               | 480     | 139.5                | 174.38             | 175       | #6          | 1                   | #2/0                 | #2/0                   | 175          | 195          | 187.2                   | 0.96                      | 1                         |
| 3.2      | SOLAR PANELBOARD | ACDS               | 480     | 279.00               | 348.75             | 350       | #3          | 1                   | #500 MCM             | #500 MCM               | 380          | 430          | 412.8                   | 0.96                      | 1                         |
| 4.1      | ACDS             | MSP                | 480     | 139.5                | 174.38             | 175       | #4          | 1                   | #2/0                 | #2/0                   | 175          | 195          | 187.2                   | 0.96                      | 1                         |
| 4.2      | ACDS             | MSP                | 480     | 279.00               | 348.75             | 350       | #1/0        | 1                   | #500 MCM             | #500 MCM               | 380          | 430          | 412.8                   | 0.96                      | 1                         |

MODULE SPECIFICATIONS

| MAKE/ MODEL  | SERAPHIM SEG-450-BMA-HV (450W) |
|--------------|--------------------------------|
| POWER [W]    | 450                            |
| ISC [A]      | 11.41                          |
| IMP [A]      | 10.77                          |
| VOC [V]      | 50.10                          |
| VMP [V]      | 41.80                          |
| β VOC [%/°C] | -0.270                         |

SITE CLIMATE CRITERIA

|                  |           |
|------------------|-----------|
| ASHRAE HIGH [°C] | 34        |
| ASHRAE LOW [°C]  | -15       |
| CONDUIT HEIGHT   | 7/8" MIN. |

INVERTER SPECIFICATIONS

| MAKE/ MODEL                | SOLAREEDGE SE50KUS         |
|----------------------------|----------------------------|
| MAX INPUT POWER [KW]       | 87.5KW (29.165KW PER MPPT) |
| NUMBER OF MPPT TRACKERS    | 3                          |
| MAX INPUT PV CURRENT [A]   | 139.5A (46.5A PER MPPT)    |
| RATED AC OUTPUT POWER [KW] | 50                         |
| RATED OUTPUT VOLTAGE [V]   | 208                        |
| MAX OUTPUT CURRENT [A]     | 139.5                      |
| CEC EFFICIENCY             | 97%                        |

DC STRING WIRING CALCULATION

|  |                                |
|--|--------------------------------|
| RAPID SHUTDOWN OUTPUT(AMPS)  | 18A                            |
| MAX CONTINUOUS FAULT CURRENT FROM PARALLEL SOURCE(AMPS)                  | 14.26A                         |
| 1.25x MAX CONTINUOUS FAULT CURRENT(AMPS)                                 | 17.82                          |
| MAX # OF WIRES PER CONDUIT   | 6                              |
| CONDUIT FILL DERATE  | 0.8                            |
| MAX. AMBIENT TEMPERATURE   | 34°                            |
| TEMPERATURE DERATE   | 0.96                           |
| WIRE GAUGE   | CU#10                          |
| 75 DEG. AMPACITY WITHOUT COU ADJUSTMENT(AMPS)                            | 35A                            |
| IS 75 DEG. AMPACITY WITHOUT COU ADJUSTMENT >= 1.25x MAX CURRENT CIRCUIT? | YES. COMPLIES WITH 690.8(B)(1) |
| 90 DEG. AMPACITY WITH COU ADJUSTMENT(AMPS)                               | 30.72A                         |
| IS 90 DEG. AMPACITY WITH COU ADJUSTMENT >= 1.0x MAX CIRCUIT CURRENT?     | YES. COMPLIES WITH 690.8(B)(2) |
| DC RAPID SHUTDOWN OUTPUT CIRCUIT FUSE RATING(AMPS)                       | 25A                            |
| AVAILABLE FAULT CURRENT FROM ALL PARALLEL SOURCE(AMPS)                   | 14.26A                         |
| IS FUSE RATING >= 1.25x MAX CIRCUIT CURRENT?                             | YES. COMPLIES WITH 690.8(B)    |

| WIRE TAG # | GRND WIRE TYPE | NEU WIRE TYPE | PHASE WIRE TYPE    | CONDUIT SIZE | CONDUIT FILL |
|------------|----------------|---------------|--------------------|--------------|--------------|
| ①          | EGC            | N/A           | CU-PV WIRE (1000V) | 3/4" EMT     | 19.84%       |
| ②          | EGC            | CU-THWN-2     | CU-THWN-2          | 2" EMT       | 28%          |
| ③.1        | EGC            | CU-THWN-2     | CU-THWN-2          | 3" EMT       | 33.12%       |
| ③.2        | EGC            | CU-THWN-2     | CU-THWN-2          | 2" EMT       | 29%          |
| ④.1        | GEC            | CU-THWN-2     | CU-THWN-2          | 3" EMT       | 34.12%       |
| ④.2        | GEC            | CU-THWN-2     | CU-THWN-2          | 3" EMT       | 34.12%       |

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NEW PV SYSTEM  
 484.2 kWp, 400 KWAC

THE GREEN ON  
 CAMPUS DRIVE

499 W 960 S ST,  
 OREM, UT 84058

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)

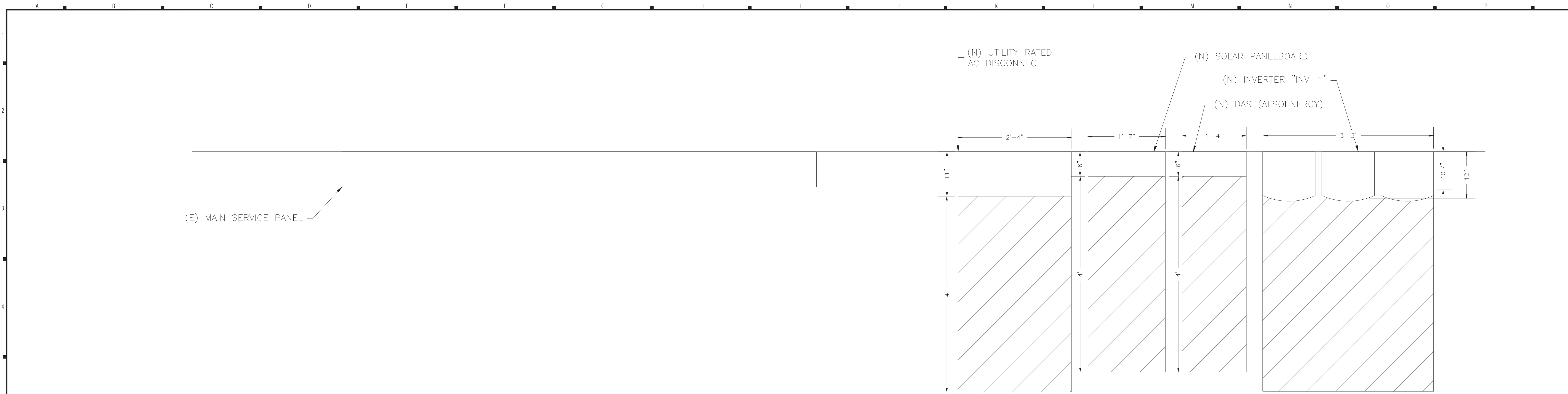
DESIGNED BY: AB

CHECKED BY: AB

SCALE:  
 NTS

SHEET TITLE:  
 WIRING  
 SCHEDULE

SHEET #:  
 E-2.2



**1 EQUIPMENT LAYOUT PLAN (ON ROOF WALL)**  
 E-3.1 SCALE: 1"=1'-0"

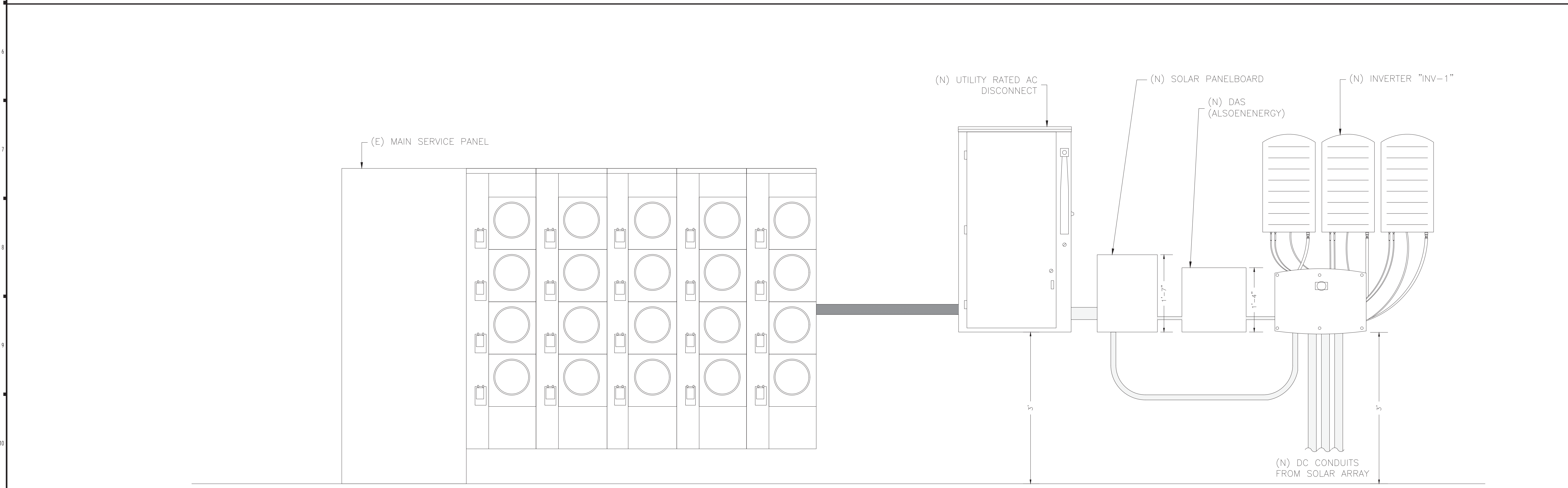
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 484.2 kWp, 400 KWAC

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 CAMPUS DRIVE

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 OREM, UT 84058



**2 EQUIPMENT ELEVATION (ON ROOF WALL)**  
 E-3.1 SCALE: 1"=1'-0"

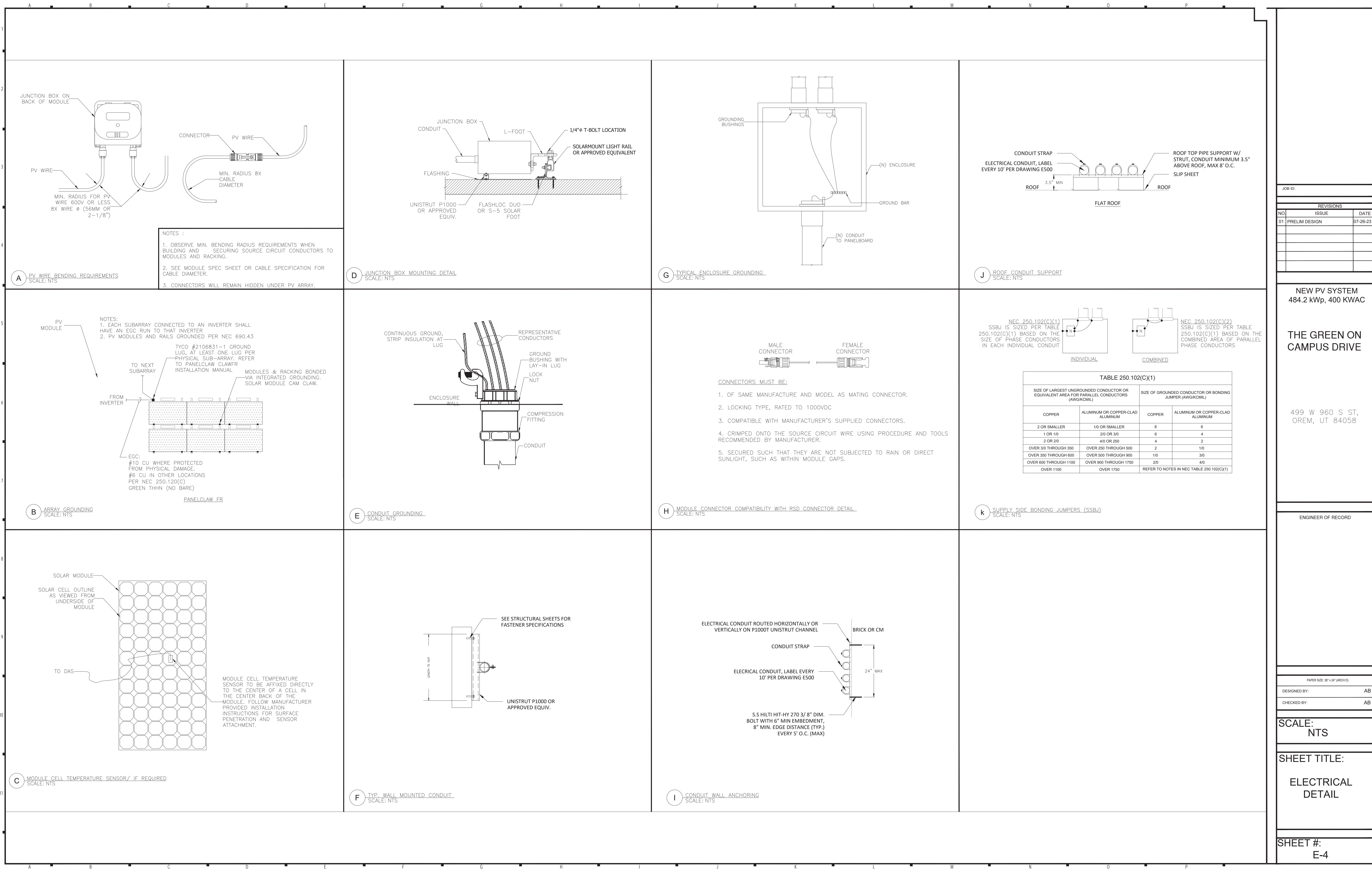
ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)  
 DESIGNED BY: AB  
 CHECKED BY: AB

SCALE:  
 1"=1'-0"

SHEET TITLE:  
 EQUIPMENT  
 ELEVATION-1  
 BUILDING-1

SHEET #:  
 E-3.1



**NOTES :**

- OBSERVE MIN. BENDING RADIUS REQUIREMENTS WHEN BUILDING AND SECURING SOURCE CIRCUIT CONDUCTORS TO MODULES AND RACKING.
- SEE MODULE SPEC SHEET OR CABLE SPECIFICATION FOR CABLE DIAMETER.
- CONNECTORS WILL REMAIN HIDDEN UNDER PV ARRAY.

**NOTES:**

- EACH SUBARRAY CONNECTED TO AN INVERTER SHALL HAVE AN EGC RUN TO THAT INVERTER
- PV MODULES AND RAILS GROUNDED PER NEC 690.43

TYCO #2106831-1 GROUND LUG, AT LEAST ONE LUG PER PHYSICAL SUB-ARRAY. REFER TO PANELCLAW CLAWFR INSTALLATION MANUAL

MODULES & RACKING BONDED VIA INTEGRATED GROUNDING-SOLAR MODULE CAM CLAW.

EGC:  
 #10 CU WHERE PROTECTED FROM PHYSICAL DAMAGE.  
 #6 CU IN OTHER LOCATIONS PER NEC 250.120(C) GREEN THHN (NO BARE)

PANELCLAW FR

**CONNECTORS MUST BE:**

- OF SAME MANUFACTURE AND MODEL AS MATING CONNECTOR.
- LOCKING TYPE, RATED TO 1000VDC
- COMPATIBLE WITH MANUFACTURER'S SUPPLIED CONNECTORS.
- CRIMPED ONTO THE SOURCE CIRCUIT WIRE USING PROCEDURE AND TOOLS RECOMMENDED BY MANUFACTURER.
- SECURED SUCH THAT THEY ARE NOT SUBJECTED TO RAIN OR DIRECT SUNLIGHT, SUCH AS WITHIN MODULE GAPS.

TABLE 250.102(C)(1)

| SIZE OF LARGEST UNGROUNDED CONDUCTOR OR EQUIVALENT AREA FOR PARALLEL CONDUCTORS (AWG/KCMIL) |                                  | SIZE OF GROUNDED CONDUCTOR OR BONDING JUMPER (AWG/KCMIL) |                                  |
|---|----------------------------------|--|----------------------------------|
| COPPER  | ALUMINUM OR COPPER-CLAD ALUMINUM | COPPER   | ALUMINUM OR COPPER-CLAD ALUMINUM |
| 2 OR SMALLER  | 1/0 OR SMALLER                   | 8  | 6                                |
| 1 OR 1/0  | 2/0 OR 3/0                       | 6  | 4                                |
| 2 OR 2/0  | 4/0 OR 250                       | 4  | 2                                |
| OVER 3/0 THROUGH 350  | OVER 250 THROUGH 500             | 2  | 1/0                              |
| OVER 350 THROUGH 600  | OVER 500 THROUGH 900             | 1/0  | 3/0                              |
| OVER 600 THROUGH 1100   | OVER 900 THROUGH 1750            | 2/0  | 4/0                              |
| OVER 1100   | OVER 1750                        | REFER TO NOTES IN NEC TABLE 250.102(C)(1)                |                                  |

SSBJ IS SIZED PER TABLE 250.102(C)(1) BASED ON THE SIZE OF PHASE CONDUCTORS IN EACH INDIVIDUAL CONDUIT

SSBJ IS SIZED PER TABLE 250.102(C)(1) BASED ON THE COMBINED AREA OF PARALLEL PHASE CONDUCTORS

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 OREM, UT 84058

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 ELECTRICAL  
 DETAIL

SHEET #:  
 E-4



1 EMT / CONDUIT RAIICEWAYS, JUNCTION BOXES  
\*(REFLECTIVE MATERIAL REQUIRED)

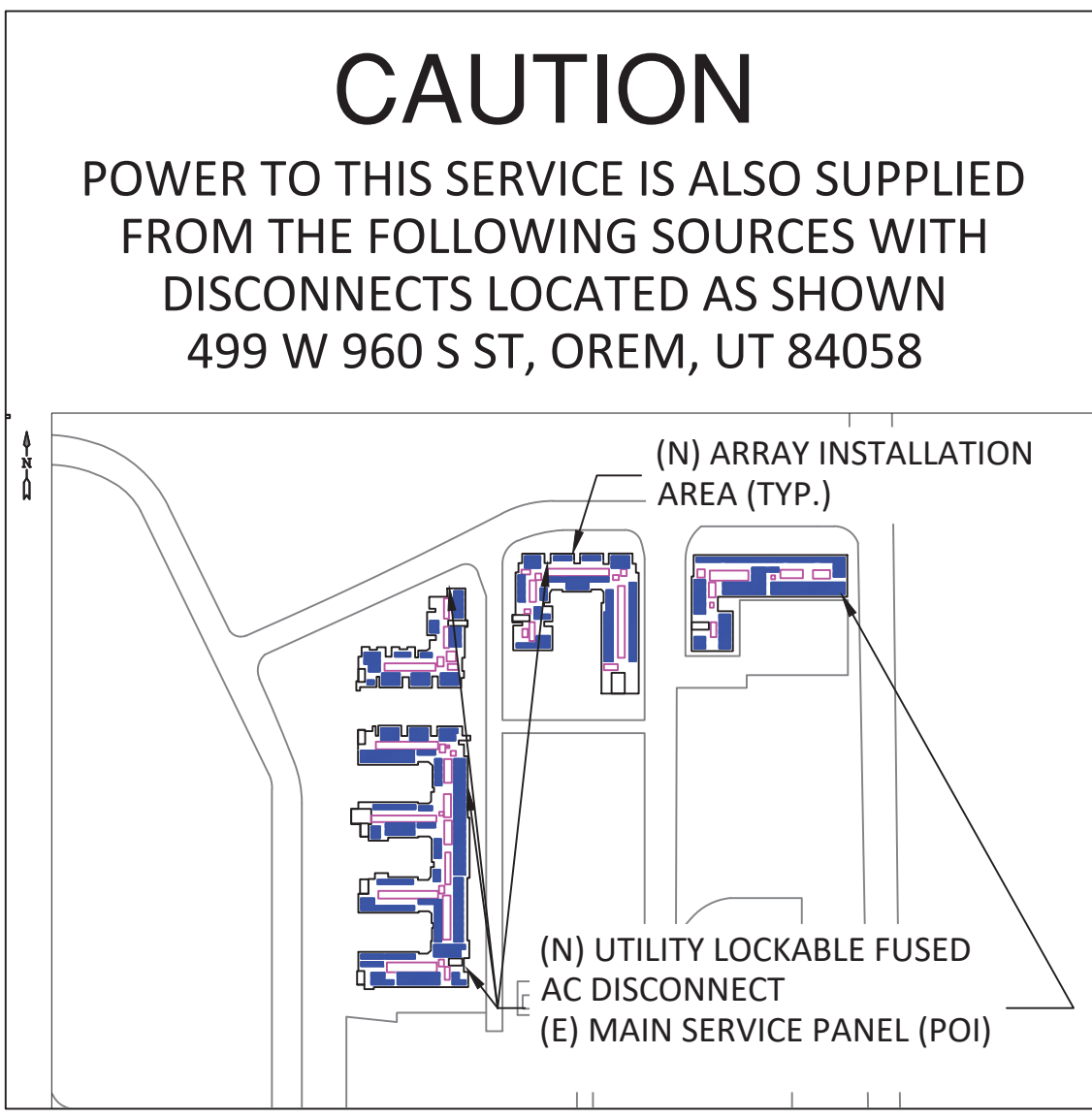
**WARNING: PHOTOVOLTAIC POWER SOURCE**

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

**WARNING PHOTOVOLTAIC POWER SOURCE**  
DO NOT REMOVE UNLESS REPLACED IN EXACT LOCATION - PV POWER CIRCUIT DIRECTLY BELOW

PER NEC 690.31(G)(1) - WHERE CIRCUITS ARE EMBEDDED IN BUILT-UP, LAMINATE, OR MEMBRANE ROOFING MATERIALS IN ROOF AREAS NOT COVERED BY PV MODULES AND ASSOCIATED EQUIPMENT.

2 BUILDING / STRUCTURE



PER NEC 690.56(B) & 705.10

3 PHOTOVOLTAIC SYSTEM AC DISCONNECT

**MAIN PHOTOVOLTAIC SYSTEM AC DISCONNECT**

PER NEC 690.13(B)

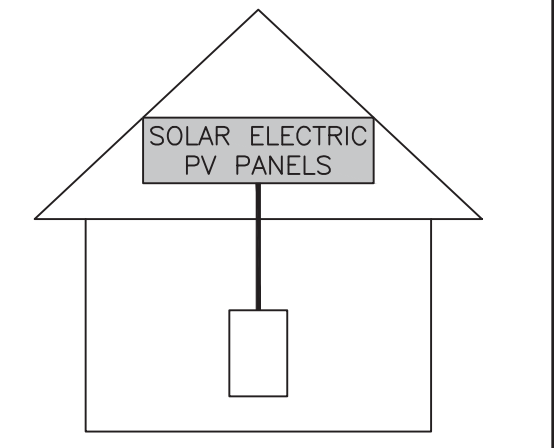
**WARNING**  
ELECTRICAL SHOCK HAZARD  
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

PER NEC 690.13(B)

**SIGNAGE NOTES:**  
1. SIGNAGE SHALL BE WEATHER RESISTANT. UL 969 SHALL BE USED AS A STANDARD FOR WEATHER RATING.  
2. ALL SIGNAGE SHALL HAVE ALL CAPITAL LETTERS WITH MINIMUM 3/8" LETTER HEIGHT FOR HEADERS & 1/4" FOR REST OF THE TEXT. TEXT WITH RED BACKGROUND TO BE OF 3/8" HEIGHT  
3. DO NOT USE SCREWS FOR SIGNAGE ATTACHMENT, USE ONLY PERMANENT ADHESIVE.

**SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN**

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



PER NEC 690.56(C)(1)(A)

**RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM**

PER NEC 690.56(C)(3)

**PHOTOVOLTAIC AC DISCONNECT "ACDS-1,3"**  
RATED AC OUTPUT CURRENT: 139.5  
NOMINAL OPERATING AC VOLTAGE: 480V

PER NEC 690.54

**PHOTOVOLTAIC AC DISCONNECT "ACDS-2,4,5"**  
RATED AC OUTPUT CURRENT: 279A  
NOMINAL OPERATING AC VOLTAGE: 480V

PER NEC 690.54

4 INVERTER

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

PER NEC 690.5(C)

**A = BLACK  
B = RED  
C = BLUE  
NEUTRAL = WHITE**

PER NEC 210.5 (C)(1)(B)

7 FIELD MARKING

NOTE:  
ELECTRICAL SERVICE EQUIPMENT MUST BE FIELD MARKED PER THE NEC CODE WHEN IT IS PRESENT IN A BUILDING OR STRUCTURE (OTHER THAN DWELLING UNITS) SUPPORTED BY MORE THAN ONE SERVICE PROVIDER (I.E., PUBLIC UTILITIES SUCH AS ELECTRICITY AND A PV SYSTEM). THIS INCLUDES ARC FLASH AND INFORMATIONAL LABELING.

a. INVERTER

INV-1

PER NEC 408.4(B)

INV-2

PER NEC 408.4(B)

b. BREAKER PANEL / PULL BOXES / MAIN SERVICE DISCONNECT

**WARNING**  
ARC-FLASH AND SHOCK HAZARD  
APPROPRIATE PPE REQUIRED

PER NEC ARTICLE 110.16 AND NFPA 70E ARTICLE 130.5(C)(1),(2),(3)

c. BREAKER PANEL

THIS PANEL FED FROM SOLAR PANELBOARD

PER NEC 408.4(B)

d. MAIN SERVICE DISCONNECT / UTILITY METER

**PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN**

PER NEC 690.56(C)

\* 3/8" TALL LETTERS ON REFLECTIVE MATERIAL

GENERAL NOTES FOR LABELS AND MARKINGS:

- Labels and markings shall be applied to the appropriate components in accordance with the NEC.
- Solar modules are supplied from the manufacturer with markings pre-applied to meet the requirements of the NEC.
- The inverter is supplied from the manufacturer with the appropriate labels and markings to meet the requirements of NEC.
- All other warning and caution labels, unless otherwise specified, must meet the requirements of ANSI Z535.4 - 2011 per Article 110.21(B) in the NEC 2014. The ANSI standard requires that Danger, Warning, and Caution signs used the standard header colors, header text, and safety alert symbol on each label. The ANSI standard requires a heading that is at least 50% taller than the body. While not required in the NEC 2014, the message text should be at least .12" tall. If we compare this to Occupational Safety and Health Administration (OSHA) 1910.145 and the American National Standard Institute (ANSI) Z535, it is specified that signs must be visible at a safe viewing distance from the hazard. They also recommend the use of safety alert symbols, where applicable.

LABELING REQUIREMENTS FOR ARTICLE 690

NEC 690.13(B)

Each photovoltaic system disconnecting means shall be permanently marked to identify it as a photovoltaic system disconnect.

NEC 690.16(B)

Non-load break rated disconnect means shall be marked.

NEC 690.17(E)

Where all terminals of the disconnecting means may be energized in the open position, a warning label shall be mounted on or adjacent to the disconnecting means.

NEC 690.31(E)(3), IFC 605.11.1.2

Labels shall appear at every section of the wiring system that is separated by enclosures, walls, partitions, ceilings or floors. Spacing between labels not to exceed 10 feet (3M).

NEC 690.33(E)(2)

Interruption current -- be a type that requires the use of a tool to open will be marked " Do Not Disconnect under Load" .

NEC 690.35(F)

A PV power source shall be labeled at each junction box, combiner box or disconnect, and device where energized, ungrounded circuits may be exposed during service.

NEC 690.4(F)

Where circuits are embedded in buildup, laminate or membrane roofing materials not covered by PV modules and associated equipment, the location of the circuits shall be clearly marked.

NEC 690.4(G)

Bipolar photovoltaic systems shall be clearly marked with a permanent, legible warning notice indicating that the disconnection of the grounded conductor(s) may result in overvoltage on the equipment.

NEC 690.5(C)

A label shall appear on the utility interactive inverter or be applied by the installer near the ground fault indicator at a visible location.

NEC 690.52

AC modules shall be marked with identification terminals or leads with the ratings as shown on the label.

NEC 690.53

A permanent label for the direct-current PV power source shall be provided by the installer at the PV disconnecting means.

NEC 690.54

All interactive system points of interconnection with other sources shall be marked at an accessible location at the disconnecting means as the power source and with the rated AC output current and the nominal operating AC voltage.

NEC 690.55

PV power systems employing energy storage shall also be marked with the maximum operating voltage, including any equalization voltage and polarity of the grounded circuit conductor.

NEC 690.56(C)

Each Rapid Shutdown Switch shall be permanently marked to identify it as a Photovoltaic Rapid Shutdown. The sign or placard shall be marked as "PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN" using white letters that are 3/8" tall on a red background and shall be reflective.

ADHESIVE FASTENED SIGNS

NEC 110.21(B)(5)

ANSI Z535.4 - 2011 Product safety signs and labels, provides guidelines for the design and durability of safety signs and labels for application to electrical equipment.

NEC 110.21

The label shall be suitable for the environment where it is installed.

NEC 110.21(B) FIELD MARKING

Where required elsewhere in this code any field applied labels, warning(s) and markings shall comply with ANSI Z535.4

IFC 605.11.1.3

Adhesive fastened signs may be acceptable if properly adhered. Vinyl signs shall be weather resistant.

REQUIREMENTS FOR ELECTRICAL INSTALLATIONS (FIELD MARKING)

NEC 110.16

Electrical equipment that are in other than dwelling units shall be field marked to warn qualified persons of a potential Arc Flash hazard.

NEC 110.24(A)

Service equipment in other than dwelling units shall be legibly field marked with the available fault current.

NEC 110.27(C)

Entrances to rooms or other guarded locations that contain exposed live parts shall be marked with conspicuous warning signs forbidding unqualified persons to enter.

NEC 210.5(C)(1)(B)

Branch Circuits: The identification methods used for conductors originating within each branch circuit shall be documented in a manner that is readily available or shall be permanently posted at each branch-circuit panelboard or distribution equipment.

NEC 230.2(E)

Where a building or structure is supported by more than one service, add a plaque to denote all other services.

NEC 408.4(B)

All switchboards and panelboards supplied by a feeder in other than one or two family dwellings shall be marked to indicate the device or equipment where the power supply(s) originates.

NEC 705.12(D)(2)(C)

In systems with panel boards connected in a series, the rating of the first overcurrent device directly connected to the output of the utility, interactive inverter(s) shall be used in calculations for all busbars and conductors. A permanent label shall be applied to the distribution equipment with the following or equivalent wording.

NEC 705.12(D)(4)

Equipment containing overcurrent devices in circuits supplying power to a busbar or conductor supplied from multiple sources shall be marked to indicate the presence of all sources.

NFPA 2018 130.5(C)

Same as NEC 110.16 but includes additional label information that is required after 9/30/2011. Check latest 2018 NFPA Arc Flash requirements.

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NEW PV SYSTEM  
484.2 kWp, 400 KWAC

THE GREEN ON  
CAMPUS DRIVE

499 W 960 S ST,  
OREM, UT 84058

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)  
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SCALE:  
NTS

SHEET TITLE:  
LABELS & MARKINGS

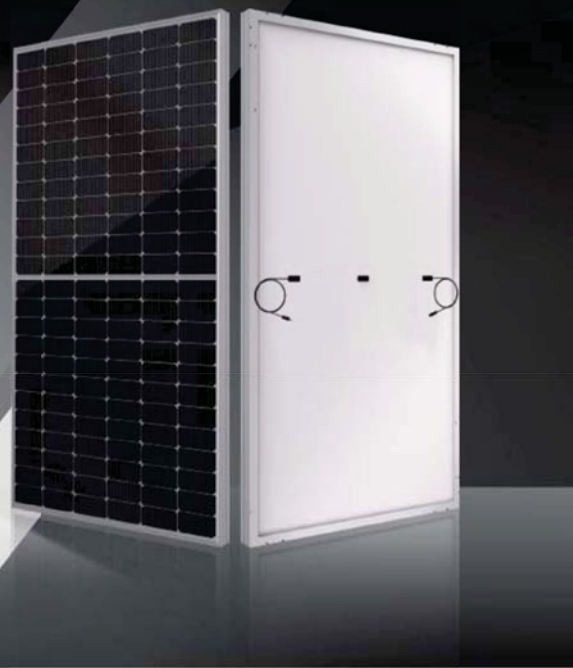
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E-5



SERAPHIM ENERGY GROUP INC. (SEG)  
www.segsolar.com

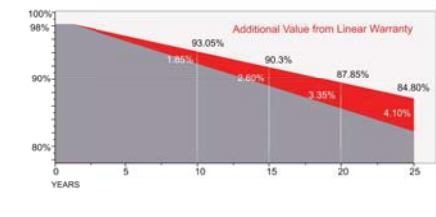
# SIII SERIES

Multiple upgrades were forged into one  
435-450W



- KEY FEATURES**
  - Less mismatch to get more power
  - Less power loss by minimizing the shading impact
  - Competitive low light performance
  - 3 times EL test to ensure best quality
  - Ideal choice for utility and commercial scale projects by reduced BoS and improved ROI
  - Outstanding reliability proven by PVEL for stringent environment condition: Sand, acid, salt and hail stones -2400 Pa wind load and 5400 Pa snow load -Anti-PID

- QUALITY SYSTEM**  
ISO9001 / ISO14001 / ISO45001
- PRODUCT CERTIFICATION**  
UL, CE, PVEL
- INSURANCE**  
PICC
- WARRANTY**  
15 Year product material and workmanship  
25 Year linear power output warranty



SERAPHIM ENERGY GROUP INC. (SEG)  
SEG Headquarters California office: 6200 Knowledge Mall Rd., Ste 200, Houston, CA 94508  
SEG San Antonio, Texas office: 573 Iron Road San Antonio, TX 78218  
Tel: 925-458-4158 Web: www.segsolar.com



SERAPHIM ENERGY GROUP INC. (SEG)  
www.segsolar.com

## Electrical Characteristics

| Module Type                  | SEG-435-BMA-HV |       | SEG-440-BMA-HV |      | SEG-445-BMA-HV |      | SEG-450-BMA-HV |      |
|------------------------------|----------------|-------|----------------|------|----------------|------|----------------|------|
|                              | STC            | NOCT  | STC            | NOCT | STC            | NOCT | STC            | NOCT |
| Maximum Power at STC (Pmp)   | 435            | 327   | 440            | 330  | 445            | 334  | 450            | 338  |
| Open Circuit Voltage (Voc)   | 49.6           | 46.3  | 49.7           | 46.4 | 49.9           | 46.6 | 50.1           | 46.8 |
| Short Circuit Current (Isc)  | 11.18          | 9.04  | 11.27          | 9.11 | 11.34          | 9.17 | 11.41          | 9.22 |
| Maximum Power Voltage (Vmp)  | 41.3           | 38.2  | 41.4           | 38.3 | 41.6           | 38.5 | 41.8           | 38.7 |
| Maximum Power Current (Imp)  | 10.54          | 8.55  | 10.63          | 8.62 | 10.70          | 8.68 | 10.77          | 8.73 |
| Module Efficiency at STC(ηm) | 20.01          | 20.24 | 20.47          |      | 20.70          |      |                |      |

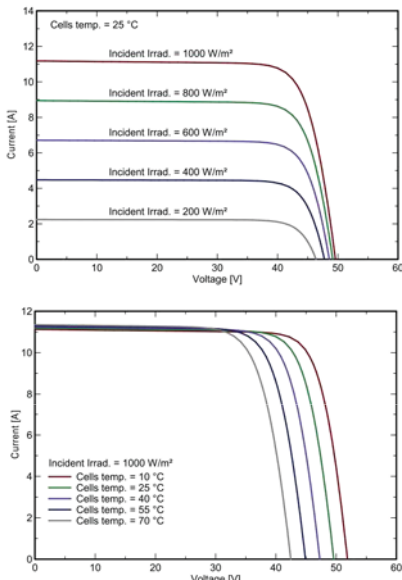
## Temperature Characteristics

|   |              |
|---|--------------|
| Pmax Temperature Coefficient              | -0.35 %/°C   |
| Voc Temperature Coefficient               | -0.27 %/°C   |
| Isc Temperature Coefficient               | +0.05 %/°C   |
| Operating Temperature                     | -40 ~ +85 °C |
| Nominal Operating Cell Temperature (NOCT) | 45±2 °C      |

## Mechanical Specifications

|                     |  |
|---------------------|--|
| External Dimensions | 2094 x 1038 x 35 mm  |
| Weight              | 23.5 kg  |
| Solar Cells         | PERC Mono 166 x 83mm (144pcs)                                |
| Front Glass         | 3.2 mm AR coating tempered glass, low iron                   |
| Frame               | Anodized aluminum alloy                                      |
| Junction Box        | IP68, 3 diodes   |
| Output Cables       | 4.0mm <sup>2</sup> , 250mm(+/-350mm(-)) or Customized Length |
| Mechanical Load     | Front side 5400 Pa / Rear side 2400 Pa                       |

## I-V Curve



## Packing Configuration

|                       | 2094 x 1038 x 35 mm |
|-----------------------|---------------------|
| Container             | 20GP 40HQ           |
| Pieces per Pallet     | 31 31               |
| Pallets per Container | 5 22                |
| Pieces per Container  | 155 682             |

Specifications are subject to change without further notification. SEG-05-EN-20210101 © Copyright 2021 SEG  
SEG Headquarters California office: 6200 Knowledge Mall Rd., Ste 200, Houston, CA 94508  
SEG San Antonio, Texas office: 573 Iron Road San Antonio, TX 78218  
Tel: 925-458-4158 Web: www.segsolar.com

# Power Optimizer

## For North America

P1101



25 YEAR WARRANTY

POWER OPTIMIZER

PV power optimization at the module level  
The most cost-effective solution for commercial and large field installations

- Specifically designed to work with SolarEdge inverters
- High efficiency with module-level MPPT, for maximized system energy production and revenue, and fast project ROI
- Superior efficiency (99.5%)
- Balance of System cost reduction; 50% less cables, fuses, and combiner boxes; over 2x longer string lengths possible
- Fast installation with a single bolt
- Advanced maintenance with module-level monitoring
- Module-level voltage shutdown for installer and firefighter safety
- Meets NEC requirements for arc fault protection (AFCI) and Photovoltaic Rapid Shutdown System (PVRSS)

solaredge.com



# Power Optimizer

## For North America

P1101

| Power Optimizer Model (Typical Module Compatibility)  | P1101 (for up to 2 x high power or bi-facial modules)         | Units   |
|---|---|---------|
| <b>INPUT</b>  |   |         |
| Rated Input DC Power <sup>(1)</sup>   | 100   | W       |
| Connection Method   | Single input for series connected modules                     |         |
| Absolute Maximum Input Voltage (Voc at lowest temperature)  | 120   | Vdc     |
| MPPT Operating Range  | 12.5 - 105  | Vdc     |
| Maximum Short Circuit Current (Isc)   | 14.1  | Adc     |
| Maximum Short Circuit Current per Input (Isc)   | 14.1  | Adc     |
| Maximum Efficiency  | 99.5  | %       |
| Weighted Efficiency   | 98.5  | %       |
| Overvoltage Category  | II  |         |
| <b>OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREGE INVERTER)</b>                   |   |         |
| Maximum Output Current  | 18  | Adc     |
| Maximum Output Voltage  | 85  | Vdc     |
| <b>OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREGE INVERTER OR SOLAREGE INVERTER OFF)</b> |   |         |
| Safety Output Voltage per Power Optimizer   | 1 ± 0.1   | Vdc     |
| <b>STANDARD COMPLIANCE</b>  |   |         |
| Photovoltaic Rapid Shutdown System  | Compliant with NEC 2014, 2017, 2020                           |         |
| EMC   | FCC Part 15 Class A, IEC 61000-6-2, IEC 61000-6-3             |         |
| Safety  | IEC 62709-1 Class II safety, UL 541, UL 3741, CSA C22.2#107.1 |         |
| Material  | UL94 V-0, UV resistant  |         |
| RoHS  | Yes   |         |
| <b>INSTALLATION SPECIFICATIONS</b>  |   |         |
| Compatible SolarEdge Inverters  | All commercial three phase inverters                          |         |
| Maximum Allowed System Voltage  | 1000  | Vdc     |
| Dimensions (W x H x D)  | 129 x 162 x 59 / 5.1 x 6.4 x 2.32                             | mm / in |
| Weight  | 1064 / 2.34   | g / lb  |
| Input Connector   | MC4 <sup>(2)</sup>  |         |
| Input Wire Length Options   | 1, 2, 3   | m / ft  |
| Output Wire Type / Connector  | Double Insulated, MC4   |         |
| Output Wire Length  | 2.4 / 7.8   | m / ft  |
| Operating Temperature Range <sup>(3)</sup>  | -40 to +85 / -40 to +185                                      | °C / °F |
| Protection Rating   | IP68 / NEMA4P   |         |
| Relative Humidity   | 0 - 100   | %       |

| PV System Design Using a SolarEdge Inverter <sup>(4)(5)</sup>  | 208V Grid SE1K                              | 208V Grid SE1.1K                              | 277/480V Grid SE1K                            | 277/480V Grid SE1.1K                                   |
|--|---|---|---|--|
| Compatible Power Optimizers  | P1101                                       |   |   |  |
| Minimum String   | 8   | 10  | 14  | 14   |
| Maximum String   | 15  | 19  | 27  | 27   |
| Length   | 30  | 30  | 30  | 30   |
| Maximum Continuous Power per String  | 7200  | 8820  | 15300   | 15300  |
| Maximum Allowed Connected Power per String <sup>(6)</sup>  | 1 string - 8400<br>2 strings or more - 9600 | 1 string - 10020<br>2 strings or more - 10200 | 1 string - 17550<br>2 strings or more - 20300 | 2 strings or less - 17550<br>3 strings or more - 20300 |
| Parallel Strings of Different Lengths or Orientations  | Yes   |   |   |  |
| Maximum Difference in Number of Power Optimizers Allowed Between the Shortest and Longest String Connected to the Same Inverter Unit | 5 Power Optimizers                          |   |   |  |

<sup>(1)</sup> The same value applies for strings units of equivalent power ratings, that are part of the modular Synergy Technology Inverter.  
<sup>(2)</sup> For each string, a Power Optimizer may be connected to a single PV module or 2; it is the only Power Optimizer connected to a single PV module in the string.  
<sup>(3)</sup> Design with three phase 208V inverters is limited. Use the SolarEdge Designer for verification.  
<sup>(4)</sup> To connect more STC power per string, design your project using SolarEdge Designer.  
<sup>(5)</sup> SolarEdge Technologies, Ltd. All rights reserved. SOLAREGE, the SolarEdge logo, OPTIMIZER and PVRSS are trademarks or registered trademarks of SolarEdge Technologies, Inc. All other trademarks mentioned herein are trademarks of their respective owners. Date: January 2021 (09/26/2021). Subject to change without notice.  
<sup>(6)</sup> RoHS

# Three Phase Inverter with Synergy Technology

## For the 208V Grid for North America

SE50KUS

INVERTERS



Powered by unique pre-commissioning process for rapid system installation

- Pre-commissioning feature for automated validation of system components and wiring during the site installation process and prior to grid connection
- Easy 2-person installation with lightweight, modular design (each inverter consists of 3 Synergy units and 1 Synergy Manager)
- Independent operation of each Synergy unit enables higher uptime and easy serviceability
- Built-in thermal sensors detect faulty wiring ensuring enhanced protection and safety
- Built-in arc fault protection and rapid shutdown
- Built-in PID mitigation for maximized system performance
- Monitored\* and field-replaceable surge protection devices, to better withstand surges caused by lightning or other events
- Built-in module-level monitoring with Ethernet or cellular communication for full system visibility

\*Applicable only for DC and AC SPDs

solaredge.com



# Three Phase Inverter with Synergy Technology

## For the 208V Grid for North America

SE50KUS

| MODEL NUMBER   | SE50K-USx210000   | UNITS |
|--|---|-------|
| <b>OUTPUT</b>  |   |       |
| Rated AC Active Output Power   | 50000   | W     |
| Maximum AC Apparent Output Power   | 50000   | VA    |
| AC Output Line Connections   | 3W + PE, 4W + PE  |       |
| Supported Grids  | WYE TN-C, TN-S, TN-C-S, TT, IT, Delta, IT   |       |
| AC Output Voltage Minimum-Nominal-Maximum <sup>(1)</sup> (L-N)                                       | 105 - 120 - 132.5   | Vac   |
| AC Output Voltage Minimum-Nominal-Maximum <sup>(1)</sup> (L-L)                                       | 183 - 208 - 229   | Vac   |
| AC Frequency Min-Nom-Max <sup>(1)</sup>  | 59.5 - 60 - 60.5  | Hz    |
| Maximum Continuous Output Current (per Phase, PF=1)  | 139.5   | AAC   |
| GFI Threshold  | 1   | A     |
| Utility Monitoring, Islanding Protection, Configurable Power Factor, Country Configurable Thresholds | Yes   |       |
| Total Harmonic Distortion  | ≤ 3   | %     |
| Power Factor Range   | +/-0.2 to 1   |       |
| <b>INPUT</b>   |   |       |
| Maximum DC Power (Module STC) Inverter / Synergy Unit  | 87500 / 23965   | W     |
| Transformer-less, Ungrounded   | Yes   |       |
| Maximum Input Voltage DC+ to DC-   | 500   | Vdc   |
| Operating Voltage Range  | 370 - 600   | Vdc   |
| Maximum Input Current  | 3 x 46.5  | Adc   |
| Reverse-Polarity Protection  | Yes   |       |
| Ground-Fault Isolation Detection   | 167mΩ sensitivity per Synergy Unit <sup>(2)</sup>   |       |
| CEC Weighted Efficiency  | 97  | %     |
| Nighttime Power Consumption  | < 12  | W     |
| <b>ADDITIONAL FEATURES</b>   |   |       |
| Supported Communication Interfaces <sup>(3)</sup>  | 2 x RS485, Ethernet, Wi-Fi (optional), Cellular (optional)  |       |
| Smart Energy Management  | Export Limitation   |       |
| Inverter Communication   | With the setApp mobile application using built-in Wi-Fi access point for local connection                   |       |
| Arc Fault Protection   | Built-in, User Configurable (According to UL 1699B)   |       |
| Photovoltaic Rapid Shutdown System   | NEC 2014, 2017 and 2020, Built-in   |       |
| PID Rectifier  | Nighttime, built-in   |       |
| TS485 Surge Protection (ports 1+2)   | Type II, field-replaceable, integrated  |       |
| AC DC Surge Protection   | Type II, field-replaceable, integrated  |       |
| DC Fuses (Single Pole)   | 25A, integrated   |       |
| Pre-Commissioning  | Built-in <sup>(4)</sup>   |       |
| <b>DC SAFETY SWITCH</b>  |   |       |
| DC Disconnect  | Built-in  |       |
| <b>STANDARD COMPLIANCE</b>   |   |       |
| Safety   | UL 1699B, UL 1741, UL 1741 SA, UL 1741 SB, UL 3098, CSA C22.2#107.1, Canadian AFCI according to T.I.L. M-07 |       |
| Grid Connection Standards  | IEEE 1547-2018, Rule 21, Rule 14 (H)  |       |
| Emissions  | FCC part 15 class A   |       |

<sup>(1)</sup> For other regional settings please contact SolarEdge support.  
<sup>(2)</sup> Where permitted by local regulations.  
<sup>(3)</sup> For specifications of the optional communication options, visit the [Communication product page](#) or the [Resource Library](#) to download the relevant product datasheet.  
<sup>(4)</sup> Not available for 10% Stock-overflow.

| REVISIONS |               |          |
|-----------|---------------|----------|
| NO.       | ISSUE         | DATE     |
| 01        | PRELIM DESIGN | 07-26-23 |

NEW PV SYSTEM  
484.2 kWp, 400 KWAC

THE GREEN ON  
CAMPUS DRIVE

499 W 960 S ST,  
OREM, UT 84058

ENGINEER OF RECORD

PAPER SIZE: 36" x 24" (ARCH D)

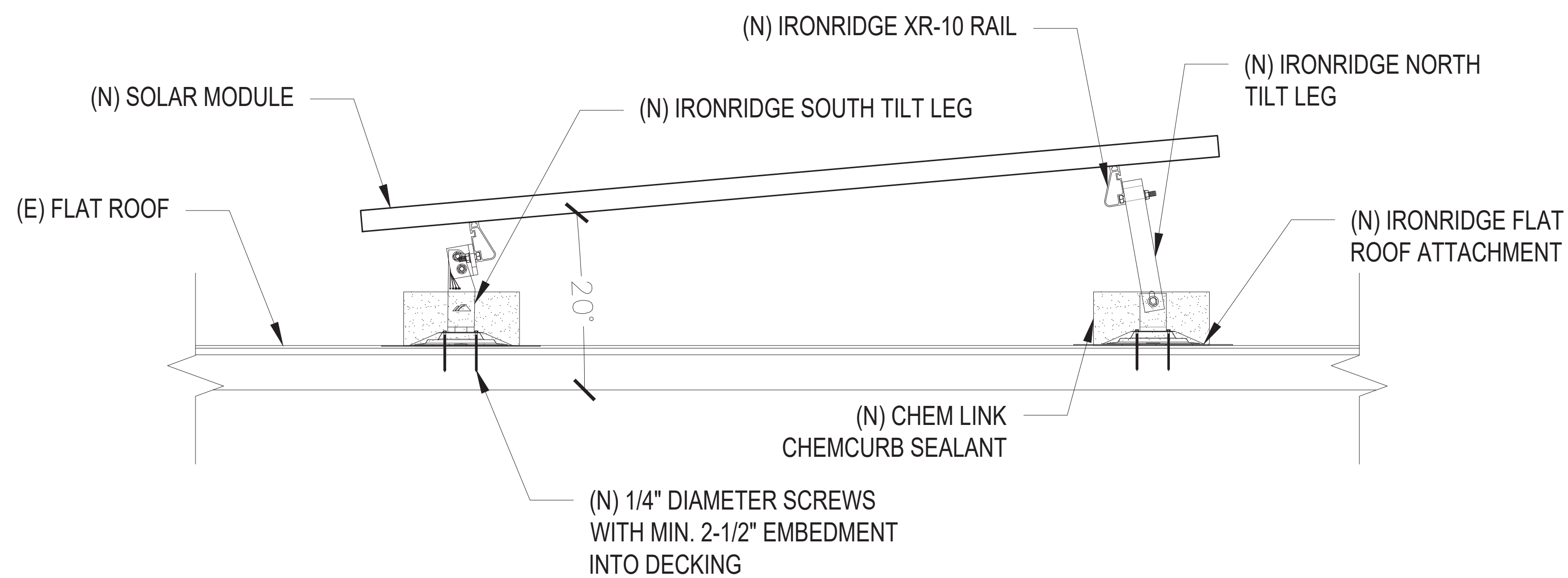
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CHECKED BY: AB

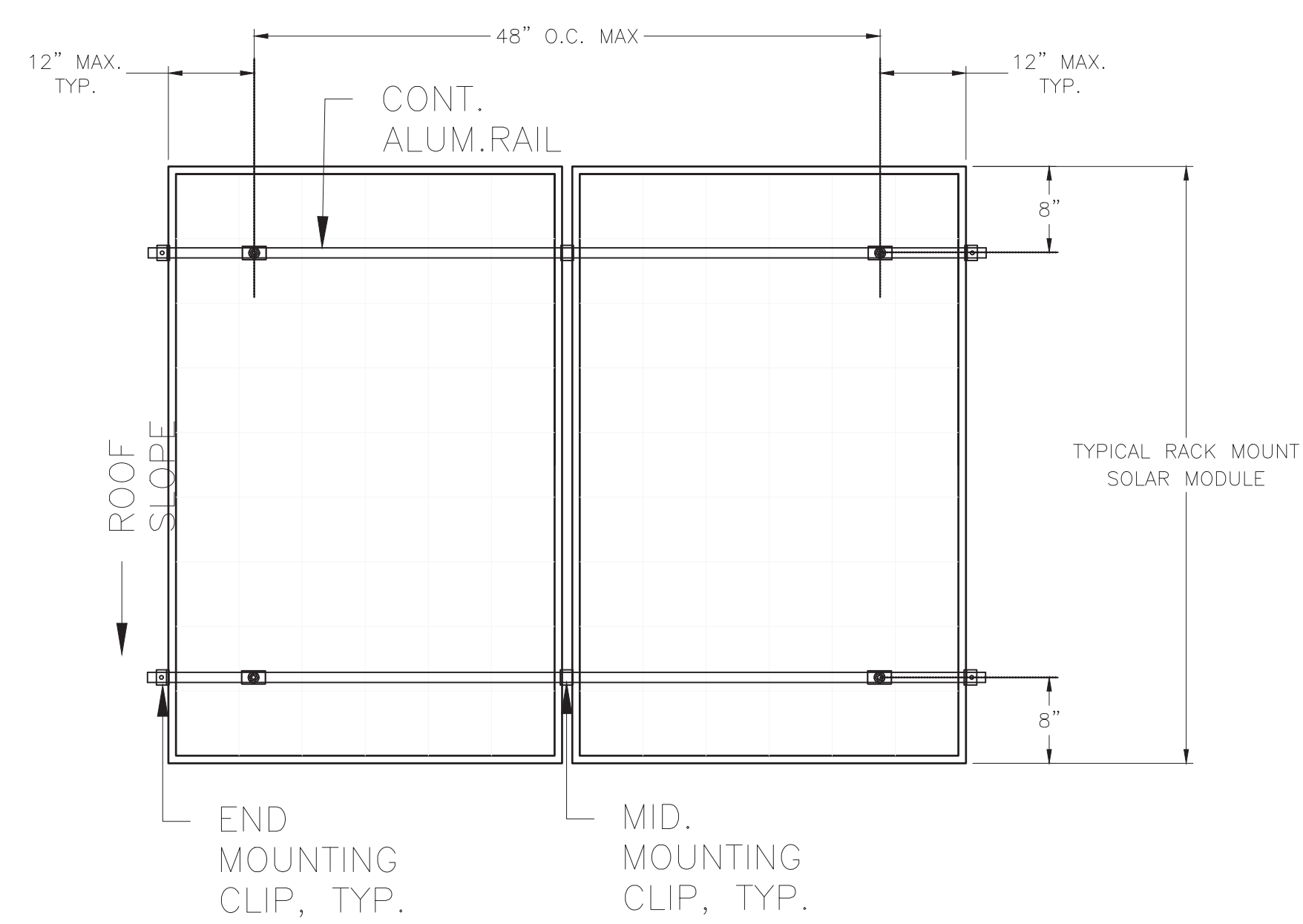
SCALE:  
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SHEET TITLE:  
ELECTRICAL  
SPECS

SHEET #:  
E-6



**1** TYPICAL RACK MOUNT LAYOUT  
S1 SCALE: NTS



**2** TYPICAL RACK MOUNT LAYOUT  
S1 SCALE: NTS

JOB ID:

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CHECKED BY: AB

SCALE:  
NTS

SHEET TITLE:

STRUCTURE  
DETAILS

SHEET #:  
S-1



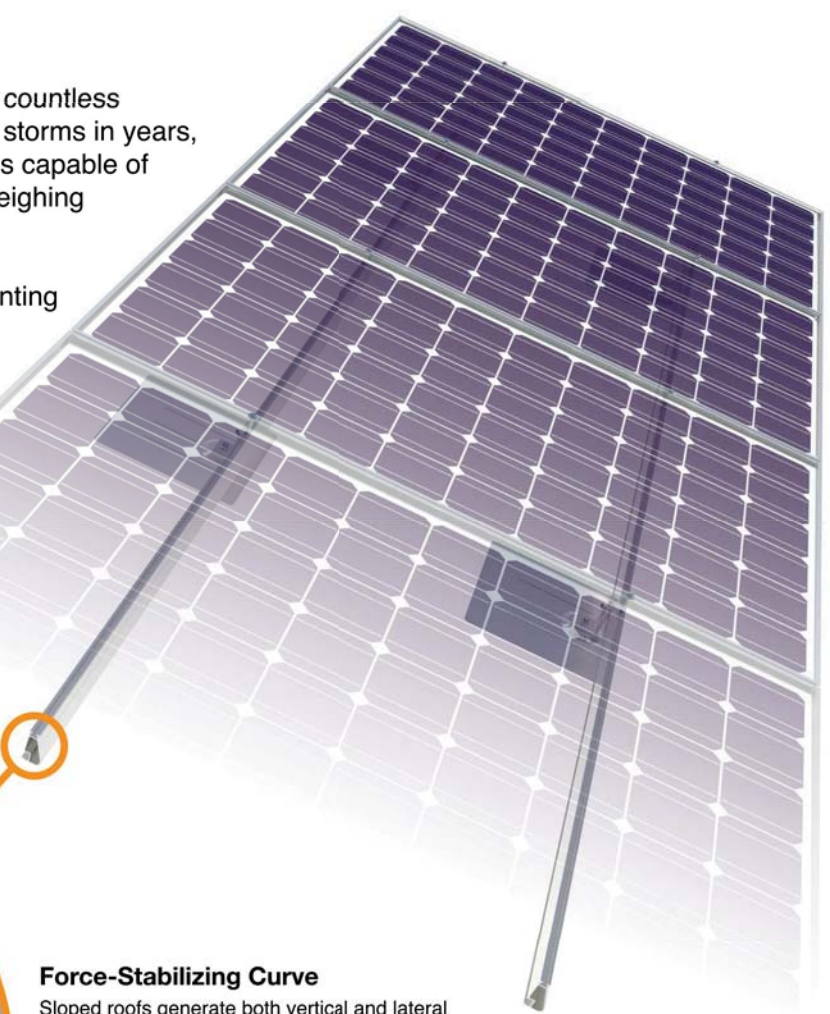
# XR Rail Family

Tech Brief

## Solar Is Not Always Sunny

Over their lifetime, solar panels experience countless extreme weather events. Not just the worst storms in years, but the worst storms in 40 years. High winds capable of ripping panels from a roof, and snowfalls weighing enough to buckle a panel frame.

XR Rails are the structural backbone preventing these results. They resist uplift, protect against buckling and safely and efficiently transfer loads into the building structure. Their superior spanning capability requires fewer roof attachments, reducing the number of roof penetrations and the amount of installation time.



**Force-Stabilizing Curve**  
Sloped roofs generate both vertical and lateral forces on mounting rails which can cause them to bend and twist. The curved shape of XR Rails is specially designed to increase strength in both directions while resisting the twisting. This unique feature ensures greater security during extreme weather and a longer system lifetime.

**Compatible with Flat & Pitched Roofs**  
XR Rails are compatible with FlashFoot and other pitched roof attachments.  
IronRidge offers a range of tilt leg options for flat roof mounting applications.

**Corrosion-Resistant Materials**  
All XR Rails are made of 6000-series aluminum alloy, then protected with an anodized finish. Anodizing prevents surface and structural corrosion, while also providing a more attractive appearance.

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# XR Rail Family

Tech Brief

The XR Rail Family offers the strength of a curved rail in three targeted sizes. Each size supports specific design loads, while minimizing material costs. Depending on your location, there is an XR Rail to match.



**XR10**  
XR10 is a sleek, low-profile mounting rail, designed for regions with light or no snow. It achieves 6 foot spans, while remaining light and economical.  
• 6' spanning capability  
• Moderate load capability  
• Clear & black anodized finish  
• Internal splices available

**XR100**  
XR100 is the ultimate residential mounting rail. It supports a range of wind and snow conditions, while also maximizing spans up to 8 feet.  
• 8' spanning capability  
• Heavy load capability  
• Clear & black anodized finish  
• Internal splices available

**XR1000**  
XR1000 is a heavy-weight among solar mounting rails. It's built to handle extreme climates and spans up to 12 feet for commercial applications.  
• 12' spanning capability  
• Extreme load capability  
• Clear anodized finish  
• Internal splices available

## Rail Selection

The following table was prepared in compliance with applicable engineering codes and standards. Values are based on the following criteria: ASCE 7-10, Roof Zone 1, Exposure B, Roof Slope of 7 to 27 degrees and Mean Building Height of 30 ft. Visit [IronRidge.com](http://IronRidge.com) for detailed span tables and certifications.

| Load       |            | Rail Span |       |       |    |        |     |
|------------|------------|-----------|-------|-------|----|--------|-----|
| Snow (PSF) | Wind (MPH) | 4'        | 5' 9" | 6'    | 8' | 10'    | 12' |
| None       | 100        |           |       |       |    |        |     |
|            | 120        |           |       |       |    |        |     |
|            | 140        | XR10      |       | XR100 |    | XR1000 |     |
|            | 160        |           |       |       |    |        |     |
| 10-20      | 100        |           |       |       |    |        |     |
|            | 120        |           |       |       |    |        |     |
|            | 140        |           |       |       |    |        |     |
|            | 160        |           |       |       |    |        |     |
| 30         | 100        |           |       |       |    |        |     |
|            | 160        |           |       |       |    |        |     |
| 40         | 100        |           |       |       |    |        |     |
|            | 160        |           |       |       |    |        |     |
| 50-70      | 160        |           |       |       |    |        |     |
| 80-90      | 160        |           |       |       |    |        |     |

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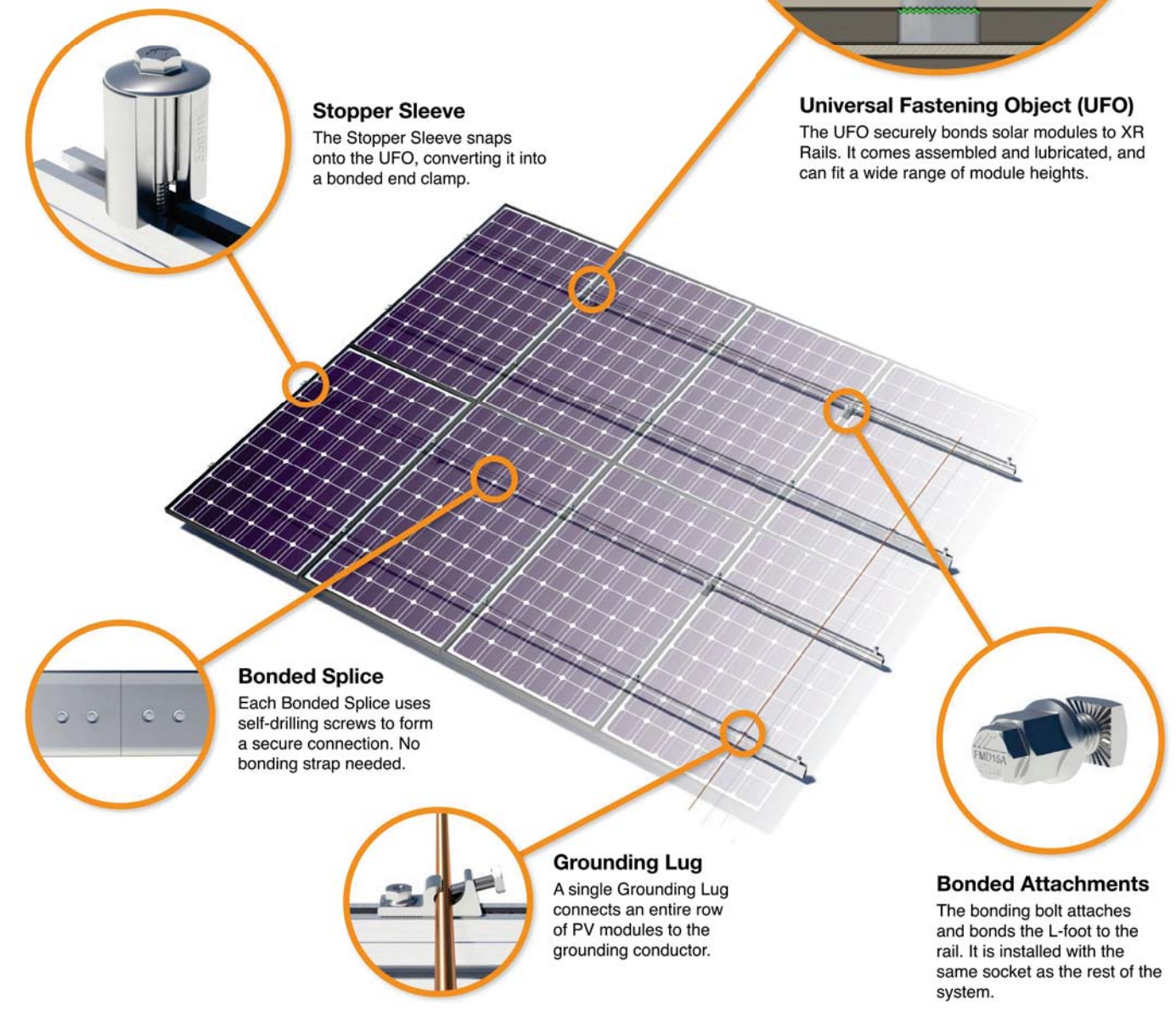
# UFO Family of Components

Tech Brief

## Simplified Grounding for Every Application

The UFO family of components eliminates the need for separate grounding hardware by bonding solar modules directly to IronRidge XR Rails. All system types that feature the UFO family—Flush Mount, Tilt Mount and Ground Mount—are fully listed to the UL 2703 standard.

UFO hardware forms secure electrical bonds with both the module and the rail, resulting in many parallel grounding paths throughout the system. This leads to safer and more reliable installations.



**Stopper Sleeve**  
The Stopper Sleeve snaps onto the UFO, converting it into a bonded end clamp.

**Universal Fastening Object (UFO)**  
The UFO securely bonds solar modules to XR Rails. It comes assembled and lubricated, and can fit a wide range of module heights.

**Bonded Splice**  
Each Bonded Splice uses self-drilling screws to form a secure connection. No bonding strap needed.

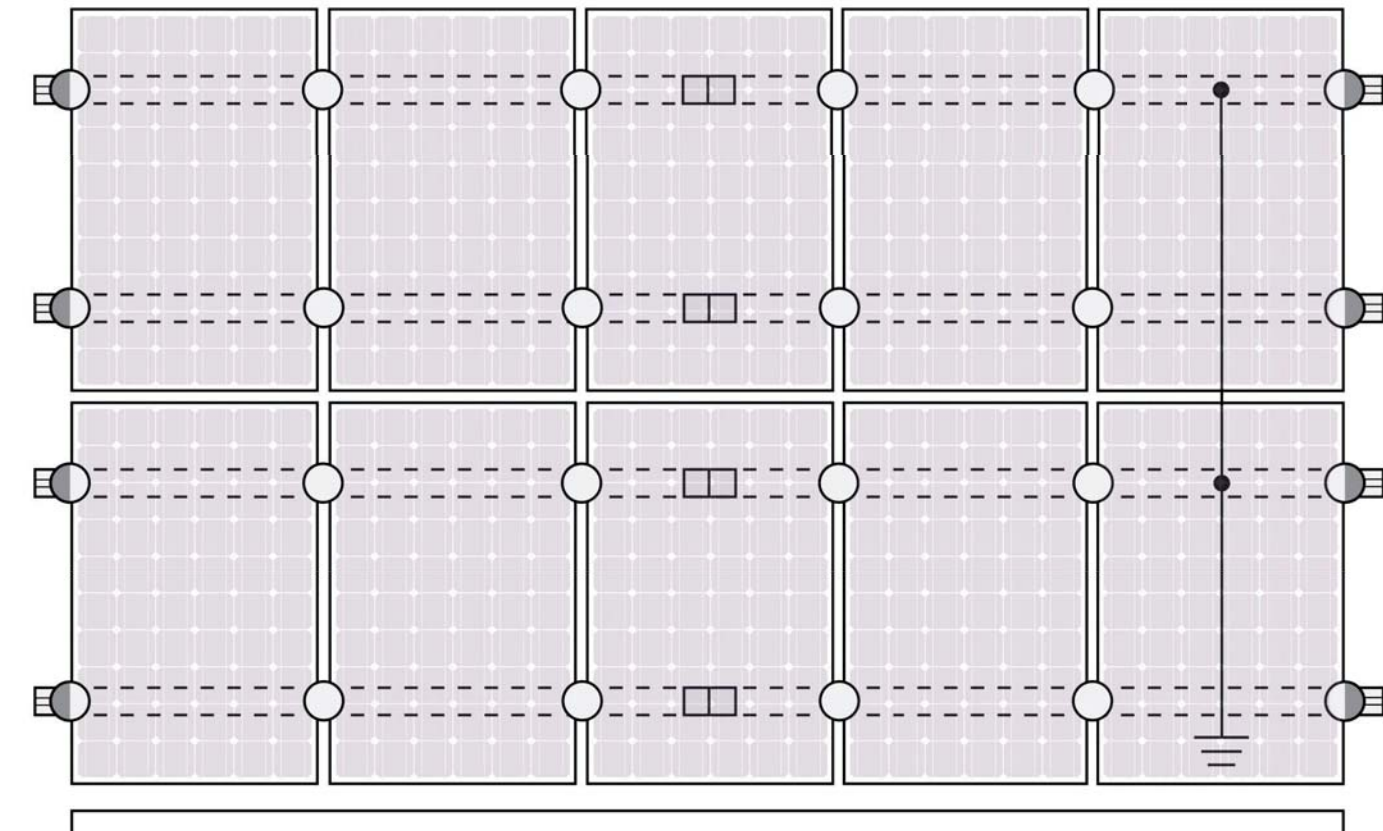
**Grounding Lug**  
A single Grounding Lug connects an entire row of PV modules to the grounding conductor.

**Bonded Attachments**  
The bonding bolt attaches and bonds the L-foot to the rail. It is installed with the same socket as the rest of the system.

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# System Diagram

Tech Brief



Approved Enphase microinverters can provide equipment grounding of IronRidge systems, eliminating the need for grounding lugs and field installed equipment ground conductors (EGC). A minimum of two microinverters mounted to the same rail and connected to the same Engage cable is required. Refer to installation manuals for additional details.

## UL Certification

The IronRidge Flush Mount, Tilt Mount, and Ground Mount Systems have been listed to UL 2703 by Intertek Group plc.

UL 2703 is the standard for evaluating solar mounting systems. It ensures these devices will maintain strong electrical and mechanical connections over an extended period of time in extreme outdoor environments.

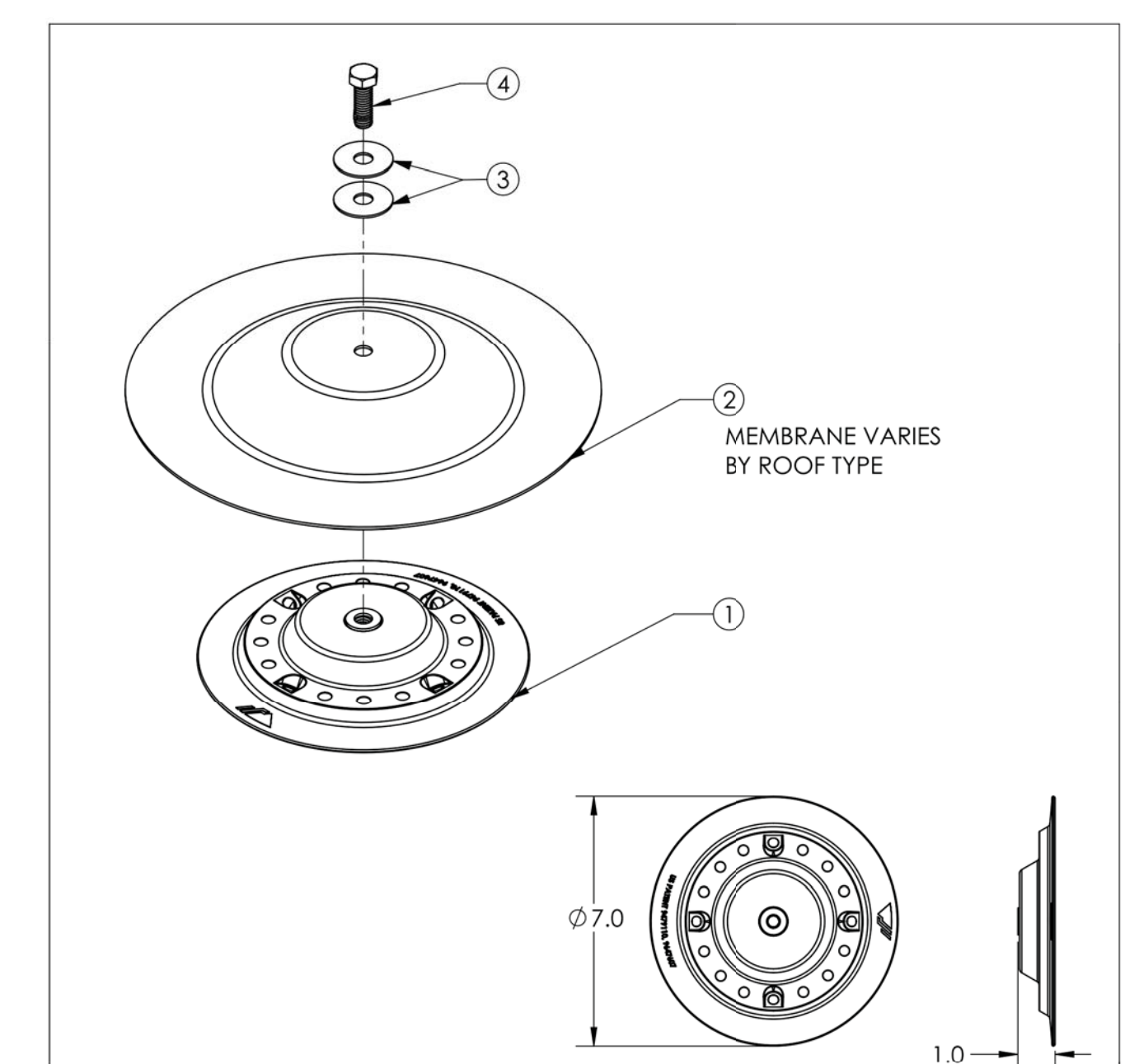
Go to [IronRidge.com/UFO](http://IronRidge.com/UFO)

| Feature                                      | Cross-System Compatibility  |            |              |
|--|---|------------|--------------|
|  | Flush Mount   | Tilt Mount | Ground Mount |
| <b>XR Rails</b>                              | ✓   | ✓          | XR1000 Only  |
| <b>UFO/Stopper</b>                           | ✓   | ✓          | ✓            |
| <b>Bonded Splice</b>                         | ✓   | ✓          | N/A          |
| <b>Grounding Lugs</b>                        | 1 per Row   | 1 per Row  | 1 per Array  |
| <b>Microinverters &amp; Power Optimizers</b> | Enphase - M250-72, M250-60, M215-60, C250-72<br>Darfon - MIG240, MIG300, G320, G640<br>SolarEdge - P300, P320, P400, P405, P600, P700, P730 |            |              |
| <b>Fire Rating</b>                           | Class A   | Class A    | N/A          |
| <b>Modules</b>                               | Tested or Evaluated with over 400 Framed Modules<br>Refer to installation manuals for a detailed list.                                      |            |              |

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# Flat Roof Attachment



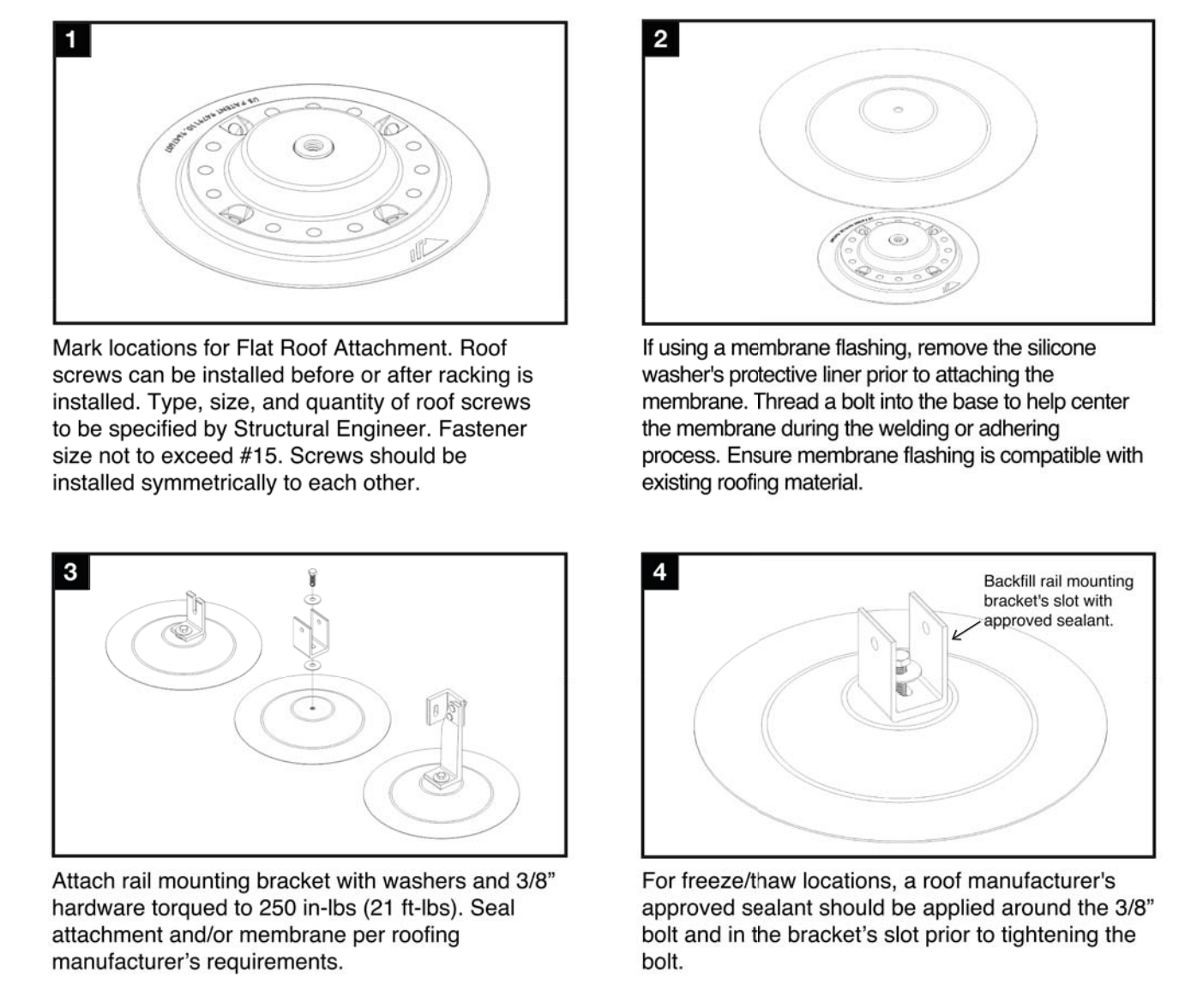
| ITEM NO. | DESCRIPTION                     |
|----------|---------------------------------|
| 1        | FLAT ROOF ATTACHMENT, BASE      |
| 2        | FLAT ROOF ATTACHMENT, MEMBRANE  |
| 3        | WASHER, FLAT 3/8" X 1.25" OD SS |
| 4        | BOLT, 3/8-16 X 1.125" HEX, SS   |

FLAT ROOF ATTACHMENT  
DO NOT SCALE DRAWING  
SCALE: 1:1 WEIGHT: 1.2 LB SHEET 1 OF 1

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# Installation

**Tools Required:** tape measure, chalk, approved sealing materials, roof screws, driver with 9/16" hex socket



Mark locations for Flat Roof Attachment. Roof screws can be installed before or after racking is installed. Type, size, and quantity of roof screws to be specified by Structural Engineer. Fastener size not to exceed #15. Screws should be installed symmetrically to each other.

If using a membrane flashing, remove the silicone washer's protective liner prior to attaching the membrane. Thread a bolt into the base to help center the membrane during the welding or adhering process. Ensure membrane flashing is compatible with existing roofing material.

Attach rail mounting bracket with washers and 3/8" hardware torqued to 250 in-lbs (21 ft-lbs). Seal attachment and/or membrane per roofing manufacturer's requirements.

For freeze/haw locations, a roof manufacturer's approved sealant should be applied around the 3/8" bolt and in the bracket's slot prior to tightening the bolt.

**Structural Certification**  
Designed and Certified for Compliance with the International Building Code & ASCE/SEI-7.  
**UL 2703**  
Conforms to UL 2703 (2015) Mechanical and Bonding requirements. See Ironridge Tilt or Flush Mount Manuals for full ratings.  
**LA Research Reports (LARR)**  
Approved for use in City of Los Angeles per LARR #26185

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NEW PV SYSTEM  
484.2 kWp, 400 KWAC  
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ENGINEER OF RECORD  
PAPER SIZE: 36" x 24" (ARCH D)  
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CHECKED BY: AB

SCALE:  
NTS

SHEET TITLE:  
STRUCTURAL  
SPECS

SHEET #:  
S-2