

CITY OF COLUMBIA, MO
INTERCONNECTION AND NET METERING AGREEMENT
Solar Power Electric Generating System Greater than 100 kW

THIS AGREEMENT (hereinafter "Agreement") is by and between the City of Columbia, Missouri (hereinafter "City"), a municipal corporation whose address is 701 E. Broadway Columbia, MO 65201 and The Missouri Conference of the United Methodist Church (hereinafter "Customer"), a business with the authority to transact business within the State of Missouri, and is entered into on the date of the last signatory below (hereinafter "Effective Date"). City and Customer are each individually referred to herein as a "Party" and collectively as the "Parties."

WHEREAS, City owns and operates an electric distribution system and provides electric services to Customer;

WHEREAS, Customer wishes to construct, operate and maintain an approved solar power electric generating facility with a capacity of more than one hundred (100) kilowatts, this facility will be on Customer's premises and it is intended primarily to offset part or all of Customer's own electrical energy requirements; and

WHEREAS, both Parties wish for Customer's facility to be permanently interconnected with the City's electric distribution system and for Customer to receive a customer-generator rate for energy that this facility produces.

NOW, THEREFORE, in consideration of the mutual covenants set out in this Agreement and for other good and valuable consideration (the receipt and sufficiency of which is hereby acknowledged), the Parties agree as follows:

1. **FACILITY DEFINITION.**

For purposes of this Agreement, "Facility" shall mean a solar powered electric generating facility, the details and location of which are attached hereto as **Exhibit A** and made a part of this Agreement.

2. **CUSTOMER RESPONSIBILITIES**

2.1. **Construction & Operation of Facility.** Customer agrees to accept responsibility for the design, construction, installation and operation of this Facility. Customer agrees to obtain all necessary governmental and regulatory permits for the construction and operation of Facility, including those required by the City, prior to any construction or installation thereof. Customer agrees to bear all costs for equipment and labor to interconnect the Facility to the City's electric distribution system. This includes, but is not limited to, all equipment necessary to maintain automatic synchronism with the City's electric distribution system and automatic disconnect between the Facility and the City's electric distribution system in the event of overload or outage of the City's electric distribution system. Facility must be designed to operate within allowable operating standards for the City's electric distribution system. Customer agrees to reimburse City for any and all losses, damages, claims, penalties or liability that may arise from operations of

the Facility. Customer agrees to maintain all equipment on the Customer's side of the delivery point, including the required disconnect device, in satisfactory operating condition consistent with the terms of this Agreement. Customer agrees to operate and maintain Facility at all times within the allowable operating standards for the City's electric distribution system and failure to do so will result in the disconnection of the Facility until the problem can be corrected.

2.2. **Facility Costs.** Customer shall be responsible for the cost, maintenance and operation of all labor and equipment on the Customer's side of the delivery point, including the required disconnect device, and to maintain any such equipment in satisfactory operating condition. Customer shall install any necessary interconnecting equipment or metering with the prior approval by City.

2.3. **Modification of Facility.** Customer shall make no Modifications to Facility without receipt of authorization from the City in writing. For purposes of this Agreement, Modifications shall mean any expansion of the Facility or any changes that may have a material impact on the safety or reliability of the City's electric transmission system. The design, installation and construction of the Modifications shall be subject to the City's review and approval. Any Modifications authorized by the City shall be done in accordance with reasonable skill, care and diligence and in accordance with the generally accepted standards of good professional practices in effect at the time of the modification.

2.4. **Pre-Operation Inspection.** Prior to interconnection, Customer shall obtain an electrical permit from the City allowing the attachment of Facility to the City's electric distribution system. Facility and associated interconnection equipment shall be inspected and approved by a designated inspector of the City prior to interconnection.

3. CITY REIMBURSEMENT AMOUNT FOR FACILITY CONSTRUCTION UNDER CITY'S COMMERCIAL ENERGY EFFICIENCY PROGRAM

3.1. **Reimbursement Amount.** City agrees to provide Customer with a reimbursement for Facility construction of up to 100 kW capacity in an amount Customer's Facility qualifies for as determined by the terms of the City's Photovoltaic System Rebate, Interconnection, and Net Metering Guidelines (hereinafter "Net Metering Guidelines"), attached hereto as **Exhibit B** and made a part of this Agreement.

3.2. **NOT TO EXCEED.** It is expressly understood by both Parties that in no event will the total amount of reimbursement to be paid by City under this Agreement exceed **Fifty Thousand Dollars (\$50,000)**, unless otherwise agreed to by both Parties in writing and executed as an amendment to this Agreement.

3.3. **Reimbursement Billing and Payment.** The billing and payment procedures for reimbursement provided in this Article 3 shall be consistent with the Net Metering Guidelines, attached hereto as Exhibit B.

4. NET METERING

maximum available fault current. The over-current protective device shall be clearly marked to indicate power source and the connection to the City's system.

5.3. Disconnection.

a. *Disconnection Switch.* Customer agrees to install a manual, lockable, load-break disconnect switch with clear indication of the switch position in a location at or near the main point of service that is easily visible and accessible to City staff. The disconnect switch shall provide a point of separation between the Facility and the City's electric system.

b. *Disconnection.* City may disconnect the Facility from the City's electric system for any reason that the City deems necessary, including but not limited to, maintenance, emergency work, unsafe or hazardous conditions, adverse effects to the City's electric service or other Customers, or for any failure of the facility to comply with codes and/or regulations. Should the Facility be disconnected and locked by the City for any reason, the Customer agrees to not remove, tamper or bypass the disconnect for any reason until such time that CWL has approved the restoration of the interconnection between the Facility and the City's electric system.

c. *Right of Access.* City employees shall have the right to enter onto the premises of the Facility and have access to the Facility for purposes in connection with the performance of the obligations imposed on it by this Agreement including inspection and disconnection of the Facility, maintaining City property, or meet its legal obligation to provide service to its customers.

6. TERM AND TERMINATION

6.1 **Term of Agreement.** The initial term of this Agreement shall be ten (10) years commencing on the Effective Date. Thereafter the term of this Agreement shall automatically renew for two, successive five (5) year terms unless otherwise terminated as provided for herein.

6.2 **Termination for Convenience.** Either Party may terminate this Agreement at any time by providing the other Party with sixty (60) days' written notice.

6.3 **Termination for Default.** If either Party fails to perform its duties and obligations provided for herein, then that Party shall be in default. The non-defaulting Party may provide notice of the default in writing with reasoning provided. If the default is not cured within fifteen (15) calendar days from receipt of the written notice of default, then the non-defaulting Party may terminate this Agreement in whole or in part for failure to perform by providing written notice of termination. The written notice of termination will be effective immediately upon its receipt. In such event, the defaulting Party shall be liable for all damages (including all costs and attorney's fees) arising out of or related to the default.

7. INSURANCE

Customer agrees to maintain, on a primary basis and at its sole expense, at all times during this life of this Agreement, the following insurance coverages, limits, including endorsements

described herein. The requirements contained herein as well as City's review or acceptance of insurance maintained by Customer is not intended to and shall not in any manner limit or qualify the liabilities or obligations assumed by Customer under this Agreement.

Commercial General Liability. Customer agrees to maintain Commercial General Liability at a limit of liability \$2,000,000 Each Occurrence, \$3,000,000 Annual Aggregate. Coverage shall not contain any endorsement(s) excluding nor limiting Contractual Liability or Cross Liability.

Contractor may satisfy the minimum liability limits required for Commercial General Liability under an Umbrella or Excess Liability policy. There is no minimum per occurrence limit of liability under the umbrella or Excess Liability; however, the Annual Aggregate limit shall not be less than the highest "each Occurrence" limit for Commercial General Liability.

Additional Insured. Customer agrees to endorse City as an Additional Insured with a CG 2026 Additional Insured – Designated Person or Organization endorsement, or similar endorsement, to the Commercial General Liability. The Additional Insured shall read "City of Columbia, Missouri."

Certificate of Insurance. Customer agrees to provide City with Certificate of Insurance evidencing that all coverages, limits and endorsements required herein are maintained and in full force and effect. Said Certificate of Insurance shall include a minimum thirty (30) day endeavor to notify due to cancellation or non-renewal of coverage. The Certificate of Insurance shall name the City as additional insured in an amount as required in this Agreement and contain a description of the project or work to be performed.

The Parties hereto understand and agree that City is relying on, and does not waive or intend to waive by any provision of this Agreement, any monetary limitations or any other rights, immunities, and protections provided by the State of Missouri, as from time to time amended, or otherwise available to City, or its elected officials or employees.

Failure to maintain the required insurance in force may be cause for termination of this Agreement. In the event Customer fails to maintain and keep in force the required insurance or to obtain coverage from its contractors, City shall have the right to cancel and terminate this Agreement without notice.

The insurance required by this Agreement is required in the public interest and City does not assume any liability for acts of Customer and/or their employees and/or their contractors in the performance of this Agreement.

8. MISCELLANEOUS

8.1. **Hold Harmless Agreement.** To the fullest extent not prohibited by law, Customer shall indemnify and hold harmless City, its directors, officers, agents, and employees from and against all claims, damages, losses, and expenses (including but not limited to attorney's fees) arising by reason of any act or failure to act, negligent or otherwise of Customer, of any subcontractor (meaning anyone including but not limited to consultants having a contract with Customer) or a

subcontractor for part of the services), of anyone directly or indirectly employed by Customer or by any subcontractor, or anyone for whose acts Customer or its subcontractor may be liable, in connection with providing these services. This provision does not, however, require Customer to indemnify, hold harmless, or defend City from its own negligence.

8.2. No Waiver of Immunities. In no event shall the language of this Agreement constitute or be construed as a waiver or limitation for either Party's rights or defenses with regard to each Party's applicable sovereign, governmental, or official immunities and protections as provided by federal and state constitution or laws.

8.3. Governing Law and Venue. This Agreement shall be governed, interpreted and enforced in accordance with the laws of the State of Missouri and/or the laws of the United States, as applicable. The venue for all litigation arising out of, or relating to this Agreement, shall be in Boone County, Missouri, or the United States Western District of Missouri. The Parties hereto irrevocably agree to submit to the exclusive jurisdiction of such courts in the State of Missouri.

8.4. General Laws. Customer shall comply with all federal, state and local laws, rules, regulations and ordinances.

8.5. Notices. Any notice, demand, request or communication required or authorized by this Agreement shall be delivered either by hand or mailed by certified mail, return receipt request, with postage prepaid to:

IF TO CITY:

City of Columbia, MO
Utilities Department
ATTN: Director of Utilities
P.O. Box 6015
Columbia, MO 65205-6015

IF TO CUSTOMER:

The Missouri Conference of the
United Methodist Church
ATTN: Nate Berneking
3601 Amron Ct.
Columbia, MO 65202

The notice shall be deemed to have been completed when sent by certified or registered mail to the other Party at the address set forth herein, or delivered in person to said Party or their authorized representatives.

8.6. No Third-Party Beneficiary. No provision of this Agreement is intended to, nor shall it in any way, inure to the benefit of any customer, property owner or any other third party, so as to constitute any such person a third-party beneficiary under this Agreement.

8.7. Amendment. No amendment, addition to, or modification of any provision hereof shall be binding upon the Parties, and neither Party shall be deemed to have waived any provision or any remedy available to it, unless such amendment, modification or waiver is in writing and signed by a duly authorized officer or representative of the applicable Party or Parties.

8.8. **Assignment.** Neither City nor Customer shall assign, sublet or transfer interest in the Agreement without the signed written consent of the other Party.

8.9. **Contract Documents.** The Contract Documents include this Agreement and the following attachments and exhibits which are incorporated herein by reference:

Exhibit:

- A Facility Description
- B Interconnection and Net Metering Guidelines

In the event of a conflict between the terms of any of the Contract Documents and the terms of this Agreement, the terms of this Agreement control.

8.10. **Entire Agreement.** This Agreement represents the entire and integrated agreement between the Parties relative to the contracted services herein. All previous or contemporaneous contracts, representations, promises and conditions relating to the contracted services herein are superseded.

[SIGNATURES ON THE FOLLOWING PAGE]

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement by their duly authorized representatives as of the date of the last signatory to this Agreement.

CITY OF COLUMBIA, MISSOURI

By: De'Carlon Seewood, City Manager *DS*

Date: _____

ATTEST:

Sheela Amin, City Clerk

APPROVED AS TO FORM:

Nancy Thompson, City Counselor / ek

CERTIFICATION: I hereby certify that this Agreement is within the purpose of the appropriation to which it is to be charged, Account No. 17430908-505007, and that there is an unencumbered balance to the credit of such appropriation sufficient to pay therefor.

Matthew Lue, City Director of Finance

THE MISSOURI CONFERENCE OF THE
UNITED METHODIST CHURCH

By: Nathaniel Beckering

Printed
Name: Nathaniel Beckering

Title: Director of Financial Administrative Ministries

Date: 11-5-2024

Exhibit A

MO CONFERENCE OF THE UNITED METHODIST CHURCH

PHOTOVOLTAIC SYSTEM

3601 AMRON CT.
COLUMBIA, MO, 65202

SYSTEM SIZE: 136.5 kW-DC | 110 kW-AC

MODULE: (325) SILFAB SIL-420 BG [420W]

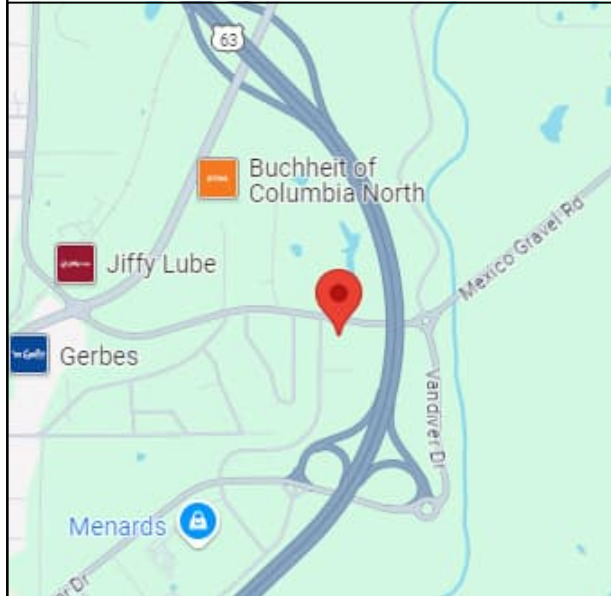
INVERTER: (3) SMA STP 20-US-50 & (2) SMA STP 25-US-50 INVERTER EQUIPPED WITH RAPID SHUTDOWN

RAPID SHUTDOWN MODULE: (325) AP SMART RSD-S-PLC

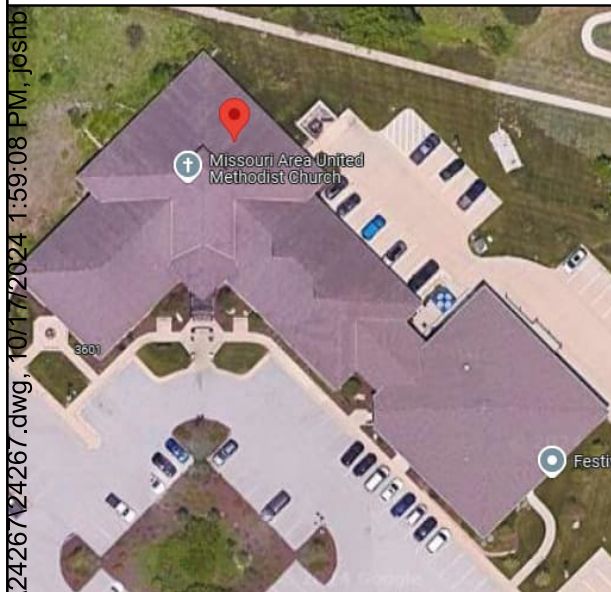
GOVERNING CODES

ALL MATERIALS, EQUIPMENT, INSTALLATION AND WORK SHALL COMPLY WITH THE FOLLOWING APPLICABLE CODES:

- 2018 ICC
- 2018 IFC
- 2017 NEC
- IEEE STANDARD 929
- UL STANDARD 1741
- OSHA 29 CFR 1910.269
- WHERE APPLICABLE, RULES OF THE PUBLIC UTILITIES COMMISSION REGARDING SAFETY AND RELIABILITY.
- THE AUTHORITY HAVING JURISDICTION
- MANUFACTURER'S LISTINGS AND INSTALLATION INSTRUCTIONS



VICINITY MAP



AERIAL MAP

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GENERAL

1. UTILITY SHALL BE NOTIFIED BEFORE ACTIVATION OF PHOTOVOLTAIC SYSTEM.
2. 110.2 APPROVAL: ALL ELECTRICAL EQUIPMENT SHALL BE LABELED, LISTED, OR CERTIFIED BY A NATIONALLY RECOGNIZED TESTING LABORATORY ACCREDITED BY THE UNITED STATES OCCUPATIONAL SAFETY HEALTH ADMINISTRATION
3. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS PRIOR TO INITIATING CONSTRUCTION.
4. CONTRACTOR SHALL REVIEW ALL MANUFACTURER INSTALLATION DOCUMENTS PRIOR TO INITIATING CONSTRUCTION.
5. ALL EQUIPMENT AND ASSOCIATED CONNECTIONS, ETC, AND ALL ASSOCIATED WIRING AND INTERCONNECTIONS SHALL BE INSTALLED ONLY BY QUALIFIED PERSONNEL.
6. THE CONTRACTOR OR OWNER MUST PROVIDE ROOF ACCESS (LADDER TO ROOF) FOR ALL THE REQUIRED INSPECTIONS. LADDERS MUST BE OSHA APPROVED, MINIMUM TYPE I WITH A 250LB. RATING, IN GOOD CONDITION AND DESIGNED FOR ITS INTENDED USE.
7. CONTRACTOR SHALL VERIFY THAT THE ROOF STRUCTURE WILL WITHSTAND THE ADDITIONAL LOADS.
8. LAG SCREWS SHALL PENETRATE A MINIMUM 2" INTO SOLID SAWN STRUCTURAL MEMBERS AND SHALL NOT EXCEED MANUFACTURER RECOMMENDATIONS FOR FASTENERS INTO ENGINEERED STRUCTURAL MEMBERS.
9. AN ACCESS POINT SHALL BE PROVIDED THAT DOES NOT PLACE THE GROUND LADDER OVER OPENINGS SUCH AS WINDOWS OR DOORS ARE LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION AND IN LOCATIONS WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREE LIMBS, WIRES, OR SIGNS.
10. WHERE DC CONDUCTORS ARE RUN INSIDE BUILDING, THEY SHALL BE CONTAINED IN A METAL RACEWAY; THEY SHALL NOT BE INSTALLED WITHIN 10" OF THE ROOF DECKING OR SHEATHING EXCEPT WHERE COVERED BY THE PV MODULES AND EQUIPMENT.

11. PLUMBING AND MECHANICAL VENTS THROUGH THE ROOF SHALL NOT BE COVERED BY SOLAR MODULES. NO BUILDING, PLUMBING OR MECHANICAL VENTS TO BE COVERED, CONSTRUCTED OR ROUTED AROUND SOLAR MODULES.
12. ALL FIELD -INSTALLED JUNCTION, PULL AND OUTLET BOXES LOCATED BEHIND MODULES SHALL BE ACCESSIBLE DIRECTLY OR BY DISPLACEMENT OF A MODULE SECURED BY REMOVABLE FASTENERS.

ELECTRICAL

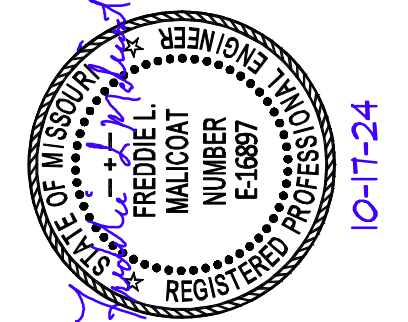
1. WIRING MATERIALS SHALL COMPLY WITH MAXIMUM CONTINUOUS CURRENT OUTPUT AT 25°C AND MAXIMUM VOLTAGE AT 1000V; WIRE SHALL BE WET RATED AT 90°C.
2. EXPOSED PHOTOVOLTAIC SYSTEM CONDUCTORS ON THE ROOF WILL BE USE 2 OR PV-TYPE WIRE.
3. PHOTOVOLTAIC SYSTEM CONDUCTORS SHALL BE IDENTIFIED AND GROUPED. THE MEANS OF IDENTIFICATION SHALL BE PERMITTED BY SEPARATE COLOR-CODING, MARKING TAPE, TAGGING OR OTHER APPROVED MEANS.
4. ALL EXTERIOR CONDUIT, FITTINGS, AND BOXES SHALL BE RAIN-TIGHT AND APPROVED FOR USE IN WET LOCATIONS.
5. ALL METALLIC RACEWAYS AND EQUIPMENT SHALL BE BONDED AND ELECTRICALLY CONTINUOUS.
6. WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, CONTRACTOR SHALL SIZE THEM ACCORDING TO APPLICABLE CODES.
7. REMOVAL OF A UTILITY-INTERACTIVE INVERTER OR OTHER EQUIPMENT SHALL NOT DISCONNECT THE BUILDING CONNECTION BETWEEN THE GROUNDING ELECTRODE CONDUCTOR AND THE PV SOURCE AND/OR OUTPUT CIRCUIT GROUNDED CONDUCTOR.
8. FOR GROUNDED SYSTEMS, THE PHOTOVOLTAIC SOURCE AND OUTPUT CIRCUITS SHALL BE PROVIDED WITH A GROUND-FAULT PROTECTION DEVICE OR SYSTEM THAT DETECTS A GROUND FAULT, INDICATES THAT FAULT HAS OCCURED AND AUTOMATICALLY DISCONNECTS ALL CONDUCTORS OR CAUSES THE INVERTER TO AUTOMATICALLY CEASE SUPPLYING POWER TO OUTPUT CIRCUITS.

9. FOR UNGROUNDED SYSTEMS, THE INVERTER IS EQUIPPED WITH GROUND FAULT PROTECTION AND A GFI FUSE PORT FOR GROUND FAULT INDICATION.
10. PV MODULE FRAMES SHALL BE BONDED TO RACKING RAIL OR BARE COPPER GEC/GEC PER THE MODULE MANUFACTURER'S LISTED INSTRUCTION SHEET.
11. PV MODULE RACKING RAIL SHALL BE BONDED TO BARE COPPER GEC VIA WEEB LUG, ILSCO GBL-4DBT LAY-IN LUG, OR EQUIVALENT LISTED LUG.
12. THE PHOTOVOLTAIC INVERTER WILL BE LISTED AS UL 1741 COMPLIANT.
13. RACKING AND BONDING SYSTEM TO BE UL2703 RATED.
14. ANY REQUIRED GROUNDING ELECTRODE CONDUCTOR WILL BE CONTINUOUS, EXCEPT FOR SPLICES OR JOINTS AS BUS BARS WITHIN LISTED EQUIPMENT.
15. WHEN BACKFED BREAKER IS THE METHOD OF UTILITY INTERCONNECTION, THE BREAKERS SHALL NOT READ "LINE AND LOAD".
16. WHEN APPLYING THE 120% RULE, THE SOLAR BREAKER TO BE POSITIONED AT THE OPPOSITE END OF THE BUS BAR FROM THE MAIN BREAKER.
17. THE WORKING CLEARANCE AROUND THE EXISTING ELECTRICAL EQUIPMENT AS WELL AS THE NEW ELECTRICAL EQUIPMENT WILL BE MAINTAINED.

SHEET INDEX:

- PV-1 - COVER PAGE
- PV-2 - PROPERTY PLAN
- PV-3 - SITE PLAN
- PV-4 - 1-LINE DIAGRAM & CALCULATION
- PV-5 - MOUNTING DETAILS
- PV-6 - ELECTRICAL LABELS & ELEVATION
- PV-7 - DATASHEETS

FREDDIE L. MALICOAT - ENGINEER
MO# E-16897



10-17-24

MALICOAT - WINSLOW ENGINEERS, INC.

MISSOURI STATE CERTIFICATE OF AUTHORITY #000421

4840 RANGELINE STREET, SUITE #101
COLUMBIA, MISSOURI 65202
TEL 573-875-1300
FREDDIE MALICOAT, P.E.

MO CONFERENCE OF THE UNITED METHODIST CHURCH

3601 AMRON CT.
COLUMBIA, MO, 65202

AHJ: CITY OF COLUMBIA, MO



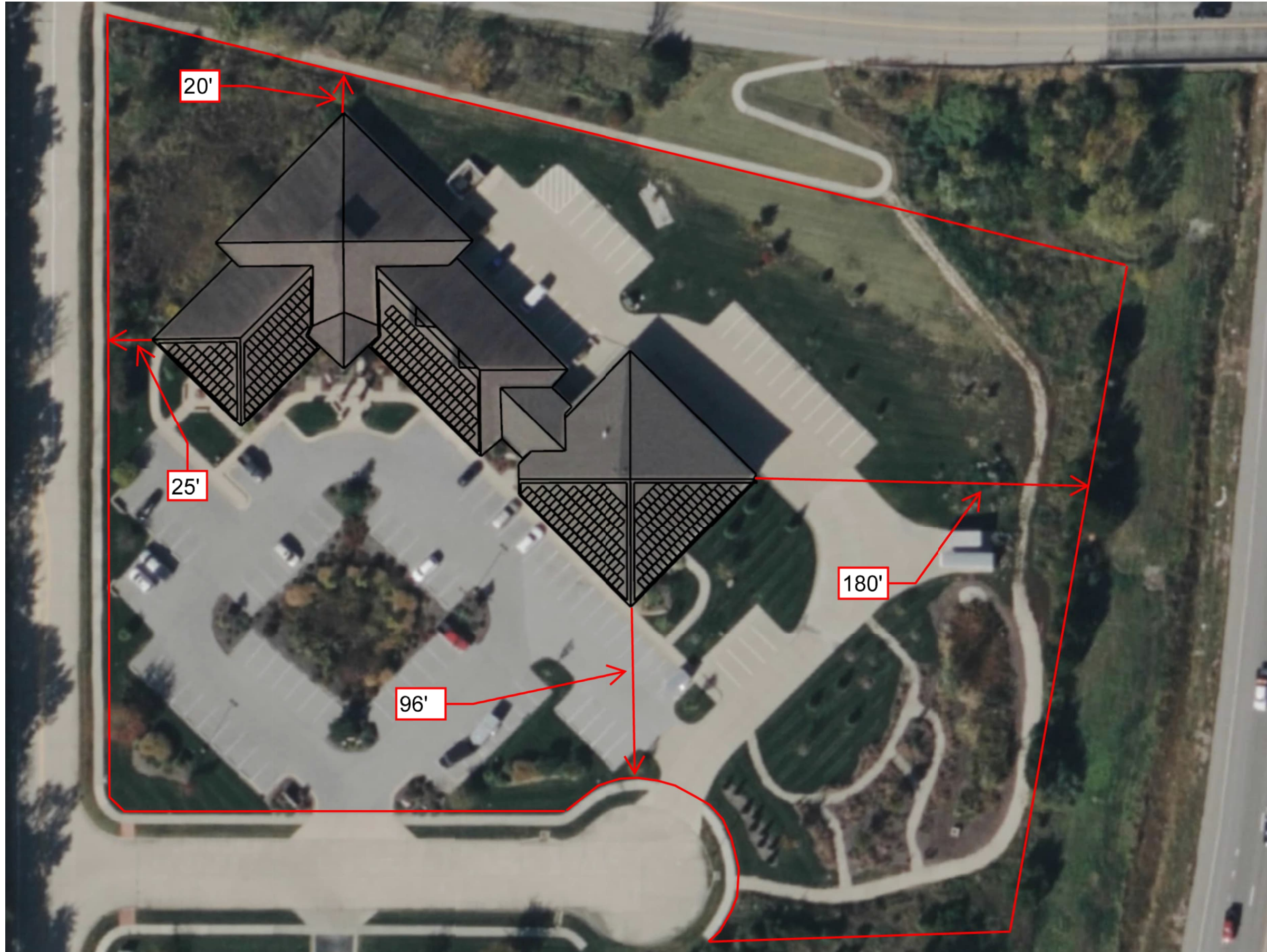
1501 CREEKWOOD PKWY, STE 110, COLUMBIA, MO, 65202-4287
573-447-6527
info@dogwoodsolar.com

COVER PAGE

DATE: 10-17-24
DRAWN BY: JDB

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REV #2:
REV #3:

PV-1

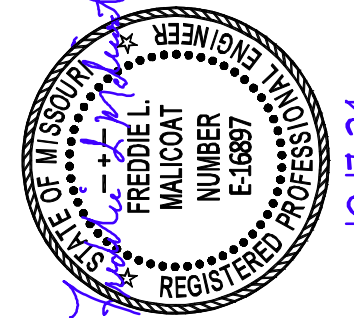


PROPERTY PLAN

SCALE: NO SCALE

VERIFY MEASUREMENTS

FREDDIE L. MALICOAT - ENGINEER
MO# E-16897



10-17-24

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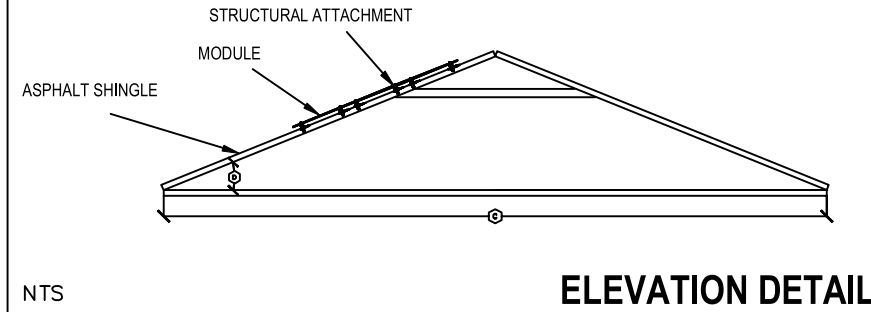
PROPERTY PLAN

DATE: 10-17-24
DRAWN BY: JDB

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REV #2:
REV #3:

PV-2

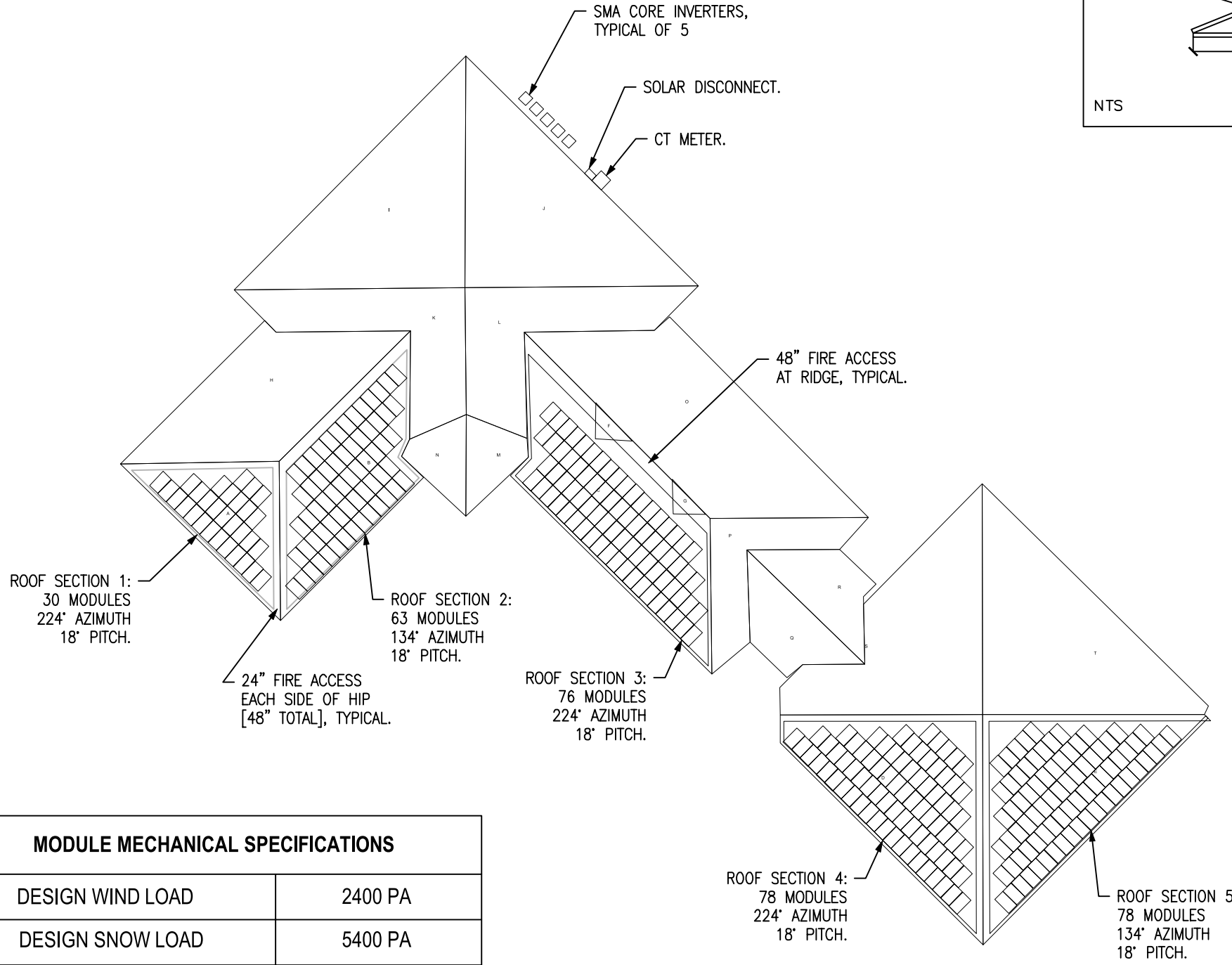
INSTALL PER MANUFACTURER INSTALLATION GUIDE



INSTALLERS TO VERIFY FRAMING SIZE, SPACING AND MAXIMUM HORIZONTAL SPAN, AND NOTIFY E.O.R. OF ANY DISCREPANCIES BEFORE PROCEEDING.

NOTE:-MAXIMUM SPACING BETWEEN STANDOFFS SHALL NOT EXCEED 6'-0"

PHOTOVOLTAIC SYSTEM:
DC SYSTEM SIZE: 136.5 kW
AC SYSTEM SIZE: 110 kW

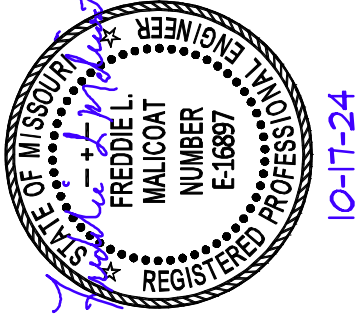


ROOF DETAIL	
ROOF TYPE: ASPHALT SHINGLE	
ROOF SECTION 1: 30 MODULES AZIMUTH: 224° PITCH: 18°	①
ROOF SECTION 2: 63 MODULES AZIMUTH: 134° PITCH: 18°	②
ROOF SECTION 3: 76 MODULES AZIMUTH: 224° PITCH: 18°	③
ROOF SECTION 4: 78 MODULES AZIMUTH: 224° PITCH: 18°	④
ROOF SECTION 5: 78 MODULES AZIMUTH: 134° PITCH: 18°	⑤

MODULE MECHANICAL SPECIFICATIONS	
DESIGN WIND LOAD	2400 PA
DESIGN SNOW LOAD	5400 PA
# OF STORIES	1
ROOF PITCH	18°
TOTAL ARRAY AREA (SQ. FT)	6,709
TOTAL ROOF AREA (SQ. FT)	31,283
ARRAY SQ. FT / TOTAL ROOF SQ. FT	21.45%

SITE PLAN
SCALE: NO SCALE VERIFY MEASUREMENTS

FREDDIE L. MALICOAT - ENGINEER
MO# E-16897



MALICOAT - WINSLOW ENGINEERS, INC.

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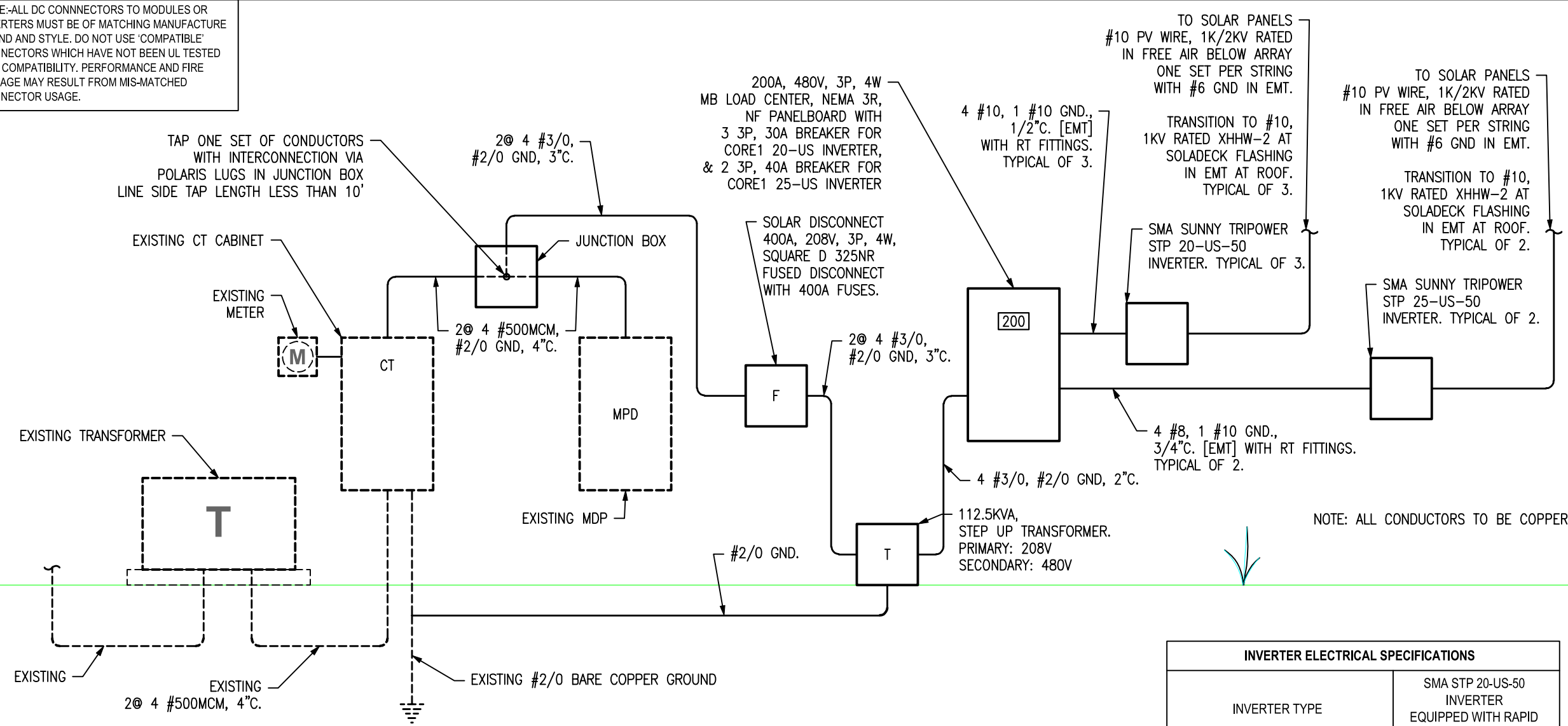
DOGWOOD SOLAR
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573-447-6527 info@dogwoodsolar.com

SITE PLAN

DATE: 10-17-24	REV #1:	PV-3
DRAWN BY: JDB	REV #2:	
	REV #3:	

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NOTE-ALL DC CONNECTORS TO MODULES OR INVERTERS MUST BE OF MATCHING MANUFACTURE BRAND AND STYLE. DO NOT USE 'COMPATIBLE' CONNECTORS WHICH HAVE NOT BEEN UL TESTED FOR COMPATIBILITY. PERFORMANCE AND FIRE DAMAGE MAY RESULT FROM MIS-MATCHED CONNECTOR USAGE.

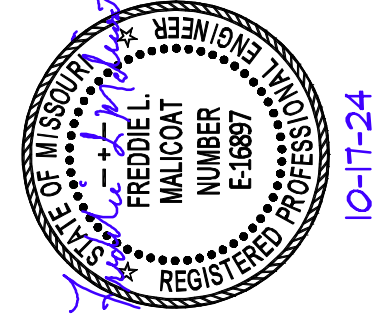


NOTE: ALL CONDUCTORS TO BE COPPER.

PHOTOVOLTAIC SYSTEM:
 DC SYSTEM SIZE: 136.5 kW
 AC SYSTEM SIZE: 110 kW
 INVERTER: (3) SMA STP 20-US-50,
 (2) SMA STP 25-US-50 INVERTER EQUIPPED
 WITH RAPID SHUTDOWN
 MODULE: (325) SILFAB SIL-420 BG [420W]

- NOTES:
1. MODULES ARE BONDED TO RAIL USING UL 2703 RATED BONDING SYSTEM - INTEGRATED BONDING MID-CLAMPS + DIRECT-BURIAL LAY-IN-LUGS; SEE ATTACHED FOR SPECIFICATIONS IF APPLICABLE
 2. PV DC SYSTEM IS UNGROUNDED
 3. PV ARRAY WILL HAVE A GROUNDING ELECTRODE SYSTEM IN COMPLIANCE WITH NEC 250.58 AND 690.47(A)
 4. PV SOURCE, OUTPUT, AND INVERTER INPUT CIRCUIT WIRING METHODS SHALL COMPLY WITH NEC 690.1(G)
 5. BACKFED PV BREAKER WILL BE INSTALLED AT OPPOSITE END OF THE BUS BAR FROM THE MAIN BREAKER. A PERMANENT WARNING LABEL TO BE INSTALLED PER SYSTEM SIGNAGE, PAGE
 6. BARE COPPER IS TRANSITIONED TO THWN-2 VIA IRREVERSIBLE CRIMP; WHEN PRESENT, THE GEC TO BE CONTINUOUS
 7. INVERTER(S) TO BE COMPLIANT WITH UL 1741 SUPPLEMENT A
 8. CONDUIT AND CONDUCTOR SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS

FREDDIE L. MALICOAT - ENGINEER
 MO# E-16897



10-17-24

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 573-447-6527 info@dogwoodsolar.com

1-LINE DIAGRAM & CALCULATION

DATE: 10-17-24	REV #1:	PV-4
DRAWN BY: JDB	REV #2:	
	REV #3:	

1 ELECTRIC RISER DIAGRAM
 SCALE: NO SCALE

PV MODULE ELECTRICAL SPECIFICATIONS	
MODULE TYPE	SILFAB SIL-420 BG [420W]
POWER MAX (P _{MAX})	420W
OPEN CIRCUIT VOLTAGE (V _{OC})	46.36V
SHORT CIRCUIT CURRENT (I _{SC})	11.4A
MAX POWER-POINT VOLTAGE (V _{MP})	38.51V
MAX POWER-POINT CURRENT (I _{MP})	10.91A
SERIES FUSE RATING	20A

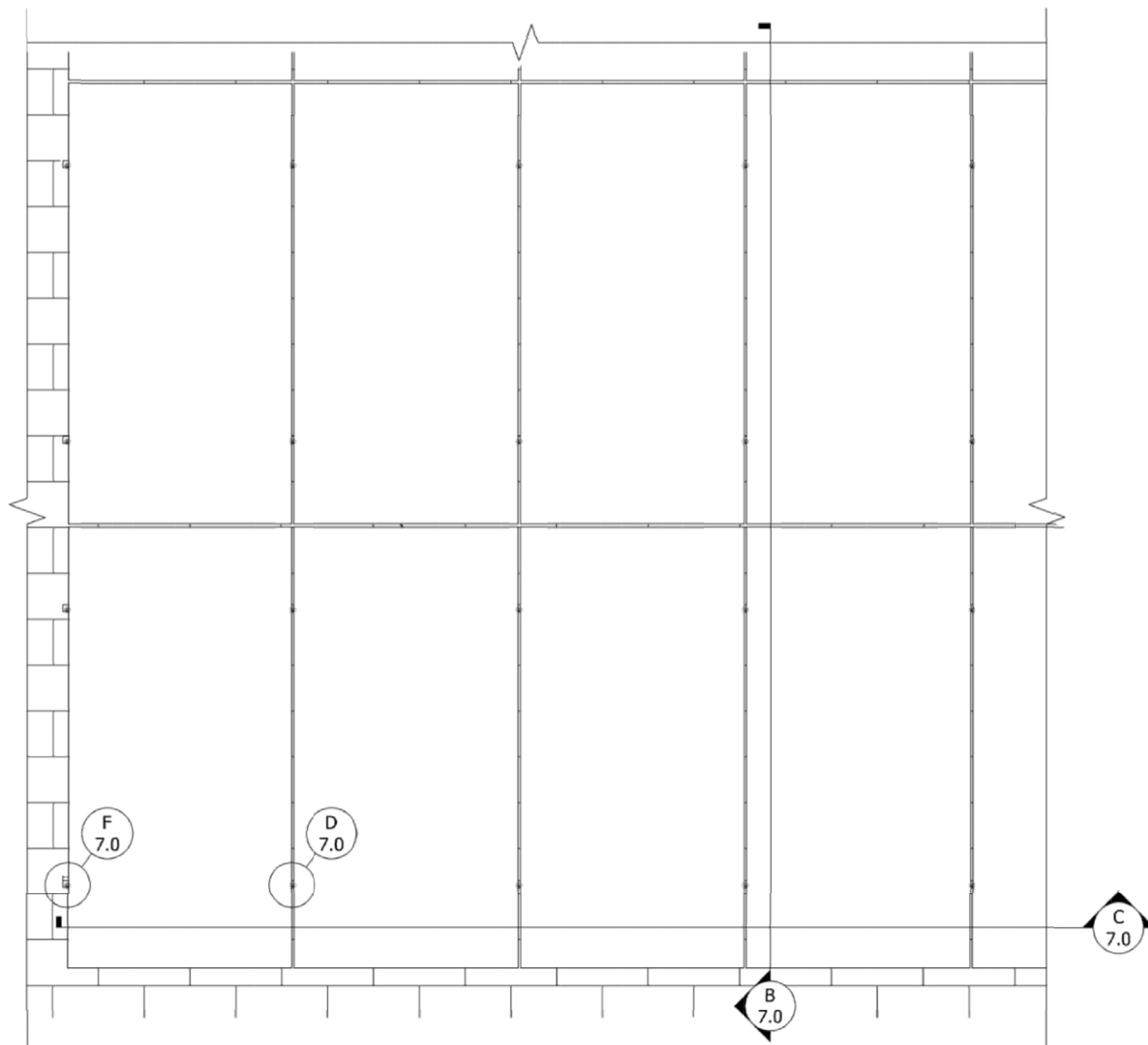
OVER-CURRENT PROTECTION DEVICE (OCPD) CALCULATIONS - SERVICE A	
INVERTER TYPE	SMA STP 20-US-41 INVERTER EQUIPPED WITH RAPID SHUTDOWN
# OF INVERTERS	3
MAX CONTINUOUS OUTPUT CURRENT INVERTER	24A
INVERTER TYPE	SMA STP 25-US-41 INVERTER EQUIPPED WITH RAPID SHUTDOWN
# OF INVERTERS	2
MAX CONTINUOUS OUTPUT CURRENT INVERTER	30A
(# OF INVERTERS) X (MAX CONT. OUTPUT CURRENT) X 125% = OCPD RATING	
((3x24+2x30) x 1.25)= 165A	

INVERTER ELECTRICAL SPECIFICATIONS	
INVERTER TYPE	SMA STP 20-US-50 INVERTER EQUIPPED WITH RAPID SHUTDOWN
MAX INPUT DC VOLTAGE	1,000V
MAX DC SHORT CIRCUIT CURRENT	37.5A
MAXIMUM OUTPUT POWER	20,000W
MAXIMUM CONT. OUTPUT CURRENT	24A
CEC EFFICIENCY	97.5%
MAX UNITS PER 24A CIRCUIT	22

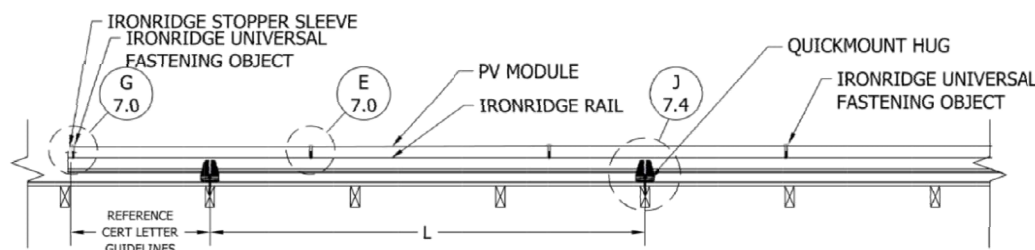
INVERTER ELECTRICAL SPECIFICATIONS	
INVERTER TYPE	SMA STP 25-US-50 INVERTER EQUIPPED WITH RAPID SHUTDOWN
MAX INPUT DC VOLTAGE	1,000V
MAX DC SHORT CIRCUIT CURRENT	37.5A
MAXIMUM OUTPUT POWER	25,000W
MAXIMUM CONT. OUTPUT CURRENT	30A
CEC EFFICIENCY	98%
MAX UNITS PER 24A CIRCUIT	22

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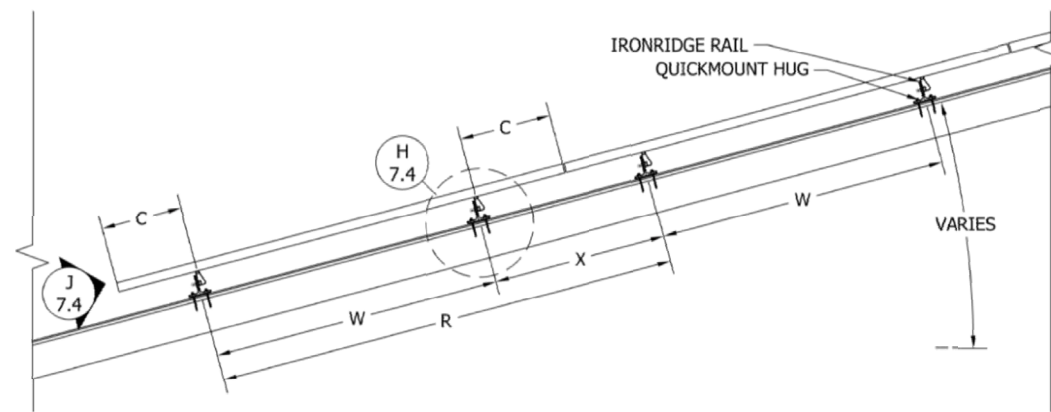
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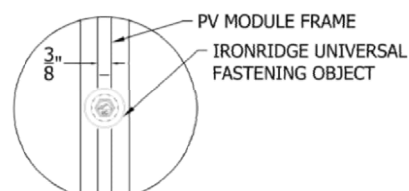
A PLAN VIEW, HUG RAFTER, PORTRAIT MODULE
Scale: 1"=1'-0"



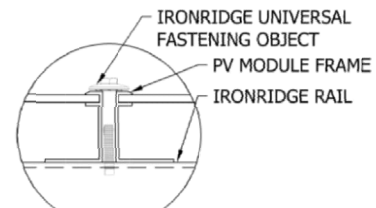
C FRONT VIEW, HUG RAFTER, PORTRAIT MODULE
Scale: 1"=1'-0"



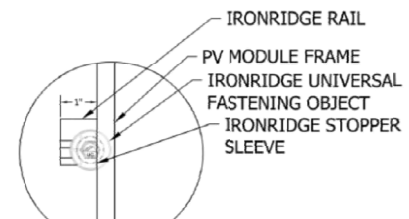
B SIDE VIEW, HUG RAFTER, PORTRAIT MODULE
Scale: 1"=1'-0"



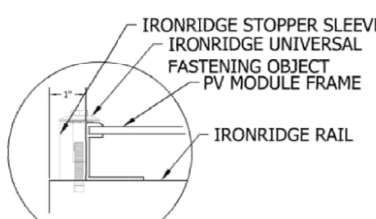
D DETAIL, MID CLAMP PLAN
Scale: 6"=1'-0"



E DETAIL, MID CLAMP FRONT
Scale: 6"=1'-0"



F DETAIL, END CLAMP (UFO) PLAN
Scale: 6"=1'-0"



G DETAIL, END CLAMP (UFO) FRONT
Scale: 6"=1'-0"

MODULE WEIGHT: 45.8 LBS
 MODULE DIMENSIONS: 73.4" X 40.5"
 MODULE WEIGHT/ SQ. FOOT: 2.22 LBS
 TOTAL NO. OF MODULES: 325
 TOTAL MODULE WEIGHT: 14885 LBS

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 MO# E-16897



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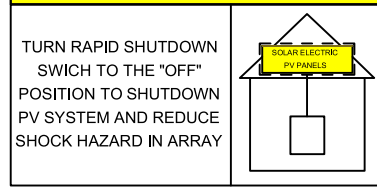
MOUNTING DETAILS

DATE: 10-17-24
 DRAWN BY: JDB

REV #1:
 REV #2:
 REV #3:

PV-5

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

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL 6
AT RAPID SHUTDOWN DISCONNECT SWITCH
[NEC 690.56(C)(3)].

PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN

LABEL 11
AT RAPID SHUTDOWN SWITCH
[NEC 690.56(C)].
LETTERS AT LEAST 3/8 INCH; WHITE ON RED BACKGROUND; REFLECTIVE
[IFC 605.11.1.1]

LABEL 15
PER XCEL ON MAIN SERVICE PANEL

THIS SERVICE PANEL IS ENERGIZED FROM MORE THAN ONE SOURCE. ONLY AUTHORIZED PERSON WHO ARE FAMILIAR WITH THIS SYSTEM SHOULD ATTEMPT TO DO SERVICE WORK ON IT

! WARNING !
ELECTRIC 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

LABEL 2
AT EACH DISCONNECTING MEANS FOR PHOTOVOLTAIC EQUIPMENT
[NEC 690.15]

! WARNING !
ELECTRIC SHOCK HAZARD
TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.

LABEL 3
AT EACH DISCONNECTING MEANS FOR PHOTOVOLTAIC EQUIPMENT
[NEC 690.13 AND 690.15]

MAXIMUM VOLTAGE: 480 V DC
MAXIMUM CIRCUIT CURRENT: 30.5A DC
MAX RATED OUTPUT CURRENT OF THE CHARGE CONTROLLER OR DC-TO-DC CONVERTER (IF INSTALLED): 30.5A DC

LABEL 4
AT EACH DC DISCONNECTING MEANS
[NEC 690.53]

PHOTOVOLTAIC AC DISCONNECT
OPERATING CURRENT: 47.5 A AC
OPERATING VOLTAGE: 240 V AC

LABEL 5
AT POINT OF INTERCONNECTION, MARKED AT DISCONNECTING MEANS
[NEC 690.54]

! WARNING !
DUAL POWER SOURCES. SECOND SOURCE IS PV SYSTEM

LABEL 7
AT POINT OF INTERCONNECTION; LABEL, SUCH AS LABEL 7 OR LABEL 8 MUST IDENTIFY PHOTOVOLTAIC SYSTEM
[NEC 705.12(B)(4)]

! CAUTION !
PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED

LABEL 8

BI-DIRECTIONAL METER

LABEL 9
AT UTILITY METER
[NEC 690.56(B)]

PHOTOVOLTAIC DC DISCONNECT

LABEL 10
AT EACH DC DISCONNECTING MEANS
[NEC 690.13(B)]

WARNING: PHOTOVOLTAIC POWER SOURCE

LABEL 12
AT EXPOSED RACEWAYS, CABLE TRAYS, AND OTHER WIRING METHODS; SPACED AT MAXIMUM 10 FT SECTION OR WHERE SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS, OR FLOORS.
[NEC 690.31(G)]
LETTERS AT LEAST 3/8 INCH; WHITE ON RED BACKGROUND; REFLECTIVE
[IFC 605.11.1.1]

UTILITY AC DISCONNECT

LABEL 13
AT EACH AC DISCONNECTING MEANS
[NEC 690.13(B)]

! WARNING !
POWER SOURCE OUTPUT CONNECTION - DO NOT RELOCATE THIS OVERCURRENT DEVICE

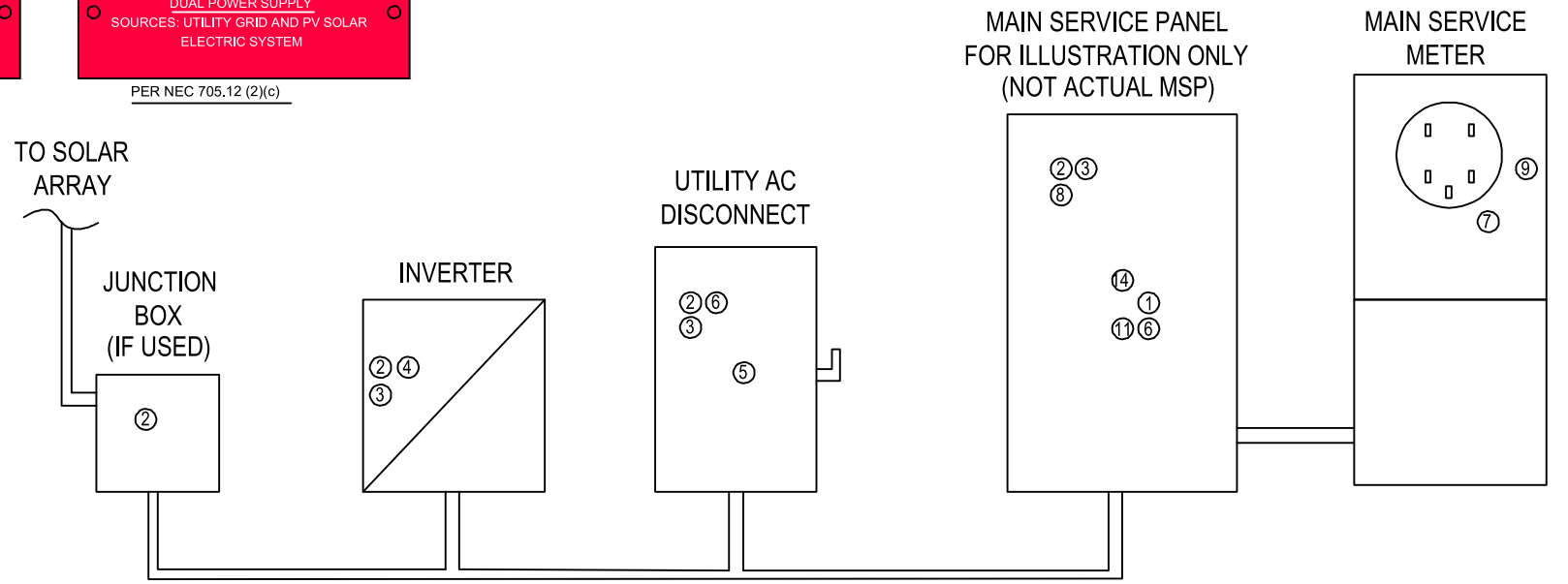
LABEL 14
AT POINT OF INTERCONNECTION OVERCURRENT DEVICE
[NEC 705.12(B)(2)(3)(B)]

#03-359 LOCAL CODES
WARNING
THIS SERVICE METER IS ALSO SERVED BY A PHOTOVOLTAIC SYSTEM

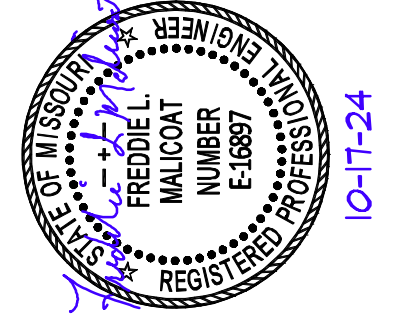
TO BE PLACED ON PRODUCTION METER
SOLAR PRODUCTION METER

WARNING: DUAL POWER SUPPLY SOURCES: UTILITY GRID AND PV SOLAR ELECTRIC SYSTEM

PER NEC 705.12 (2)(c)



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MO# E-16897



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ELECTRICAL LABELS & ELEVATION

DATE: 10-17-24
DRAWN BY: JDB
REV #1:
REV #2:
REV #3:

PV-6

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SILFAB ELITE

SIL - 420 BG



ELECTRICAL SPECIFICATIONS		420	
Test Conditions		STC	NOCT
Module Power (Pmax)	Wp	420	313
Maximum power voltage (Vpmax)	V	38.51	35.89
Maximum power current (Ipmax)	A	10.91	8.73
Open circuit voltage (Voc)	V	46.36	43.45
Short circuit current (Isc)	A	11.4	9.18
Module efficiency	%	21.9%	20.4%
Maximum system voltage (VDC)	V	1000	
Series fuse rating	A	20	
Power Tolerance	Wp	0 to +10	

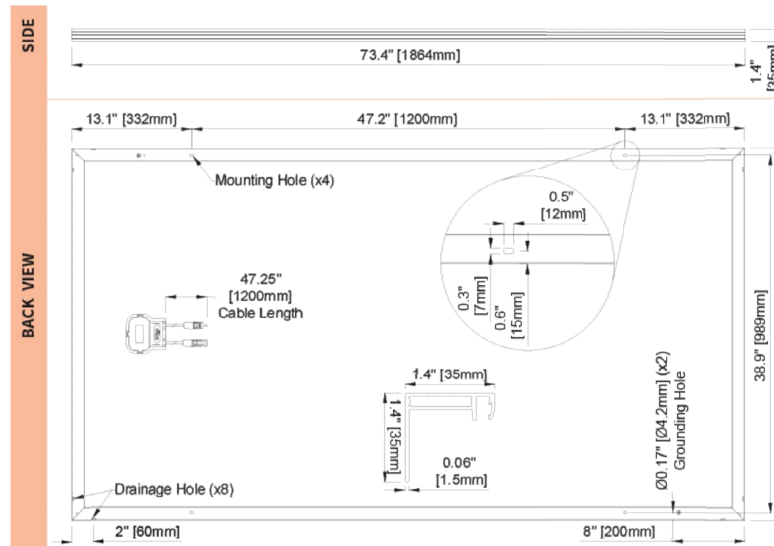
Measurement conditions: STC 1000 W/m² • AM 1.5 • Temperature 25 °C • NOCT 800 W/m² • AM 1.5 • Measurement uncertainty ± 3%
Sun simulator calibration reference modules from Fraunhofer Institute. Electrical characteristics may vary by ±5% and power by 0 to +10W.

MECHANICAL PROPERTIES / COMPONENTS	METRIC	IMPERIAL
Module weight	20.8±0.2	45.8±0.4 lbs
Dimensions (H x L x D)	1864 mm x 1029 mm x 35 mm	73.4 in x 40.5 in x 1.4 in
Maximum surface load (wind/snow)*	5400 Pa rear load / 5400 Pa front load	112.8 lb/ft ² rear load / 112.8 lb/ft ² front load
Hail impact resistance	ø 25 mm at 83 km/h	ø 1 in at 51.6 mph
Cells	66 high-efficiency mono-PERC MWT c-Si cells 166 x 166 mm	66 high-efficiency mono-PERC MWT c-Si cells 6.53 x 6.53 in
Glass	3.2 mm high transmittance, tempered, anti-reflective coating	0.126 in high transmittance, tempered, anti-reflective coating
Cables and connectors (refer to installation manual)	1200 mm ø 5.7 mm, MC4 from Staubli	47.2 in, ø 0.22 (12AWG), MC4 from Staubli
Backsheet	Multilayer, integrated insulation film and electrically conductive backsheet, superior hydrolysis and UV resistance, fluorine-free PV backsheet	
Frame	Anodized Aluminum (Black)	
Bypass diodes	3 diodes-30SQ045T (45V max DC blocking voltage, 30A max forward rectified current)	
Junction Box	UL 3730 Certified, IEC 62790 Certified, IP67 rated	

TEMPERATURE RATINGS	WARRANTIES
Temperature Coefficient Isc	Module product workmanship warranty
Temperature Coefficient Voc	Linear power performance guarantee
Temperature Coefficient Pmax	≥ 98% end 1st yr
NOCT (± 2°C)	≥ 94.7% end 12th yr
Operating temperature	≥ 90.8% end 25th yr
	≥ 89.3% end 30th yr

CERTIFICATIONS	SHIPPING SPECS
Product	Modules Per Pallet: 27 or 27 (California)
Factory	Pallets Per Truck: 31 or 30 (California)
	Modules Per Truck: 837 or 810 (California)

* Warning: Read the Safety and Installation Manual for mounting specifications and before handling, installing and operating modules.
** 12 year extendable to 25 years subject to registration and conditions outlined under "Warranty" at silfab.com.
PAN files generated from 3rd party performance data are available for download at: silfab.com/download.



SILFAB SOLAR INC.

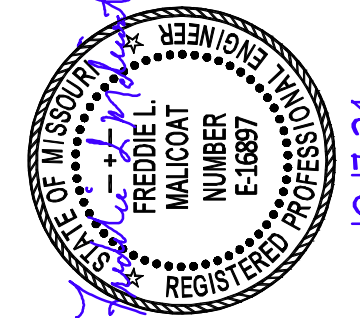
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MO# E-16897



10-17-24

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MODULE DATASHEET

DATE: 10-17-24
DRAWN BY: JDB

REV #1:
REV #2:
REV #3:

PV-7.1

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NOT JUST ANOTHER SOLAR PANEL.

Silfab Elite

Back-contact technology with an innovative conductive backsheet and integrated cell design delivers the highest performance, durability and beautiful aesthetics.

Manufactured exclusively in the United States.

SILFABSOLAR.COM



STP 20-US-50 / STP 25-US-50 / STP 30-US-50



powered by **ennexOS**

Sunny Tripower X-US

20 / 25 / 30

Integrated intelligence for future-proof system design.



Integrated System Manager

- Monitoring and control for up to 5 inverters (max. 150 kVA)
- Remote access with Sunny Portal powered by ennexOS
- SMA Dynamic Power Control

Enhanced safety

- Integrated SunSpec PLC signal for module-level shutdown
- Advanced DC AFCI arc-fault protection
- Optional DC type 2 and type 1+2 surge protection

Maximum yields

- Three MPP trackers for flexible array design
- SMA ShadeFix string level optimization
- Integrated I-V curve diagnostics ¹⁾

Smart monitoring, control and service

- SMA Smart Connected proactive monitoring and service solution
- SMA ennexOS cross-sector energy management platform
- Centerpiece of the proven SMA Energy System Business

Sunny Tripower X is the new innovative inverter solution for commercial PV systems.

Providing three MPP trackers with SMA ShadeFix string optimization technology for optimal PV array design flexibility and maximum energy yields. SMA's proven integrated rapid shutdown support and reliable DC AFCI arc-fault protection ensure enhanced system safety. And now with the new integrated System Manager, powered by SMA's ennexOS cross-sector energy management platform, Sunny Tripower X becomes the centerpiece of the SMA Energy System Business for comprehensive commercial energy systems now and in the future.

Technical data	Sunny Tripower X 20-US	Sunny Tripower X 25-US	Sunny Tripower X 30-US
Input (DC)			
Maximum PV array power	30000 Wp	37500 Wp	45000 Wp
Maximum input voltage	1000 V	1000 V	1000 V
MPP voltage range	350 V to 800 V	430 V to 800 V	515 V to 800 V
Minimum input voltage / initial input voltage		150 V / 188 V	
Maximum operating input current / short-circuit current per MPP tracker		24 A / 37.5 A	
Number of independent MPP trackers / string inputs per MPP tracker		3 / 2	
Output (AC)			
Nominal output power	20000 W	25000 W	30000 W
Maximum apparent power	20000 VA	25000 VA	30000 VA
Nominal AC voltage		480 V / 277 V	
AC voltage range		244 V to 305 V	
Rated grid frequency / range		60 Hz / 50 Hz to 66 Hz	
Maximum output current	24 A	30 A	36 A
Power factor at rated power / adjustable displacement		1 / 0.8 overexcited to 0.8 underexcited	
Output phases / line connection		3 / 3-(N)-PE	
Harmonics (THD)		< 3 %	
Efficiency			
CEC efficiency	97.5 %	98 %	98 %
Protection and safety features			
Load rated DC disconnect		•	
Ground fault monitoring / grid monitoring		•/•	
DC reverse polarity protection / AC short-circuit protection		•/•	
All-pole sensitive residual-current monitoring unit		•	
Protection class / overvoltage category		I / III	
DC AFCI arc-fault protection		•	
SunSpec PLC signal for rapid shutdown		•	
DC surge protection type 2 / DC surge arrester type 1+2		○ / ○	
General data			
Dimensions (W/H/D)		728 mm / 762 mm / 266 mm (28.7 in / 30 in / 10.5 in)	
Device Weight		35 kg / 77 lbs	
Operating temperature range		-25°C to +60°C (-13°F to +140°F)	
Noise emission (typical)		59 dB(A)	
Topology / cooling concept		Transformerless / OptiCool (forced convection, variable speed fans)	
Enclosure protection rating		Type 4X (as per UL 50E)	
Corrosivity classification according to IEC 61701		C5*	
Maximum permissible value for relative humidity (non-condensing)		100 %	
Features / functions / accessories			
Mounting type		Vertical rack / wall mount to 1.5° from horizontal	
DC connection / AC connection		Amphenol H4 Plus / spring-cage terminal	
LED indicators (status / fault / communication)		•	
Network interfaces: Ethernet / WLAN		• (2 ports) / •	
Data protocols: SMA Modbus / SunSpec Modbus / Speedwire		•/•/•	
Multi-function relay / Extension module slot / Digital inputs		•/•/• (6 inputs)	
SMA ShadeFix string level optimization		•	
Integrated I-V curve diagnostics ¹⁾		•	
Integrated Plant Control / Q on Demand 24/7		•/•	
SMA Smart Connected (proactive monitoring and service support)		•	
Standard warranty		10 years	
Optional warranty extensions (total warranty coverage cannot exceed 20 years)		+5 years, +10 years	
Certificates and approvals			
Certificates and approvals		UL 62109-1, UL 1699B Ed. 1, CAN/CSA 22.2 No. 62109-1:16 / 62109-2:16, PV Rapid Shutdown System Equipment in accordance with UL1741:2021	
FCC compliance		FCC Part 15 Class A	
Grid interconnection standards		UL 1741 S8, IEEE 1547:2018, compliance to SRDs: CA Rule 21, HECO Rule 14H, ISO-NE	
Integrated System Manager			
Maximum number of supported inverters / energy meters		5 / 1	
Maximum system power PV inverters (nominal AC power)		150 kVA	
Centralized commissioning of all devices in the system		•	
Remote parameterization of SMA devices		• (via Sunny Portal powered by ennexOS)	
SMA Dynamic Power Control (e.g. zero export / Volt-VA) ²⁾		○	
Type designation	STP 20-US-50	STP 25-US-50	STP 30US-50

• Standard features ○ Optional — Not available Data in nominal conditions Last revision: 08/2023 *≥ 500 m from the coast ¹⁾ Upcoming ²⁾ Currently free software

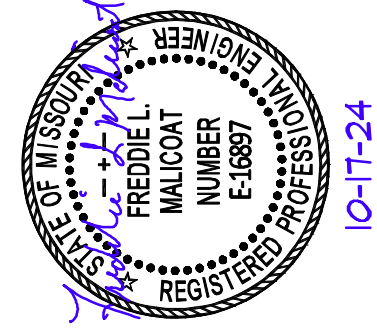
Accessories

- SMA Data Manager M EDM-M-US-10
- DC terminal cover DC-TERM-COVER
- SMA Sensor Module MD.SEN-US-40
- DC Surge Protection Kits T2: DC_SPD_KIT6-10 T1+2: DC_SPD_KIT7_T1T2

Toll Free +1 888 4 SMA USA
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SMA America, LLC

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INVERTER DATASHEET

DATE: 10-17-24	REV #1:	PV-7.2
DRAWN BY: JDB	REV #2:	
	REV #3:	

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¹⁾ upcoming



Raising the bar in innovative DC MLPE solar power systems

RSD-S-PLC

- Meets NEC 2017, 2020&2023 (690.12) requirements
- Executes rapid shutdown of system when Transmitter-PLC signal is absent
- Meets SunSpec requirements

The RSD-S-PLC meets SunSpec requirements, maintaining normal function by continually receiving a heartbeat signal from the APsmart Transmitter. The RSD executes rapid system shutdown when the Transmitter signal is absent. Users can manually execute rapid shutdown using Transmitter breaker switch.⁽¹⁾⁽²⁾

RSD-S-PLC TECHNICAL DATA

MODEL	RSD-S-PLC
INPUT DATA (DC)	
Input Operating Voltage Range	8-80V
Maximum Cont. Input Current (I _{max})	15A
Maximum Short Circuit Current (I _{sc})	25A
OUTPUT DATA (DC)	
Output Operating Voltage Range	8-80V
Maximum System Voltage	1000V/1500V
Maximum Series Fuse Rating	30A
MECHANICAL DATA	
Operating Ambient Temperature Range	-40°F to +185°F (-40 °C to + 85 °C)
Dimensions (without cable & connectors)	5.5" x 1.3" x 0.7"(140 mm x 32 mm x 18 mm)
Cable Length	Input 250mm/Output 1200mm
Cable Cross Section Size	UL:12AWG
Connector	Input: Stäubli MC4 PV-KBT4&KST4 or Customized Output: APsystems specified or Customized
Enclosure Rating	NEMA Type 6P/IP68
Protection Temperature	100°C
FEATURES & COMPLIANCE	
Communication	PLC
Safety Compliance	NEC 2017, 2020&2023 (690.12); UL1741; CSA C22.2 No. 330-17; IEC/EN62109-1; 2PFG2305
EMC Compliance	FCC Part15; ICES-003; IEC/EN61000-6-1/-2/-3/-4



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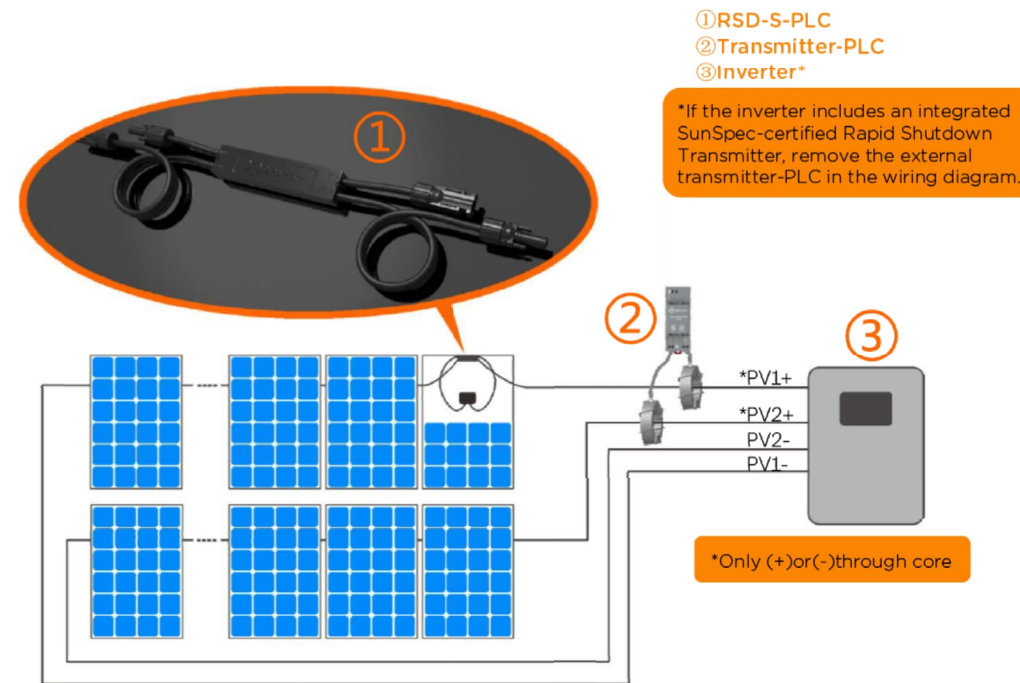
⁽¹⁾ RSD-S-PLC does not have automatic shutdown function for arc detection. When the system is abnormal, the transmitter signal is cut off by pulling the gate, which triggers shutdown.

⁽²⁾ RSD-S-PLC is designed to reduce the risk of fire suppression but does not solve the risk of an arc fire.

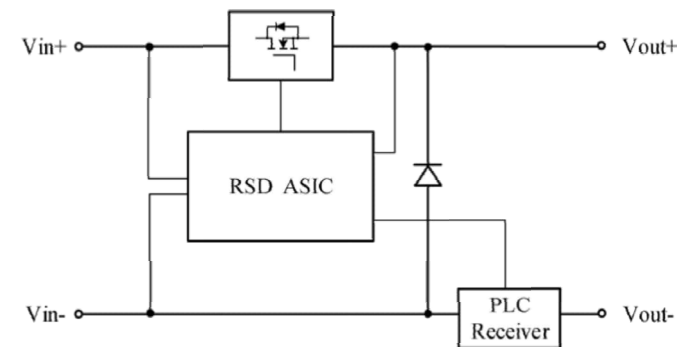
REV3.0 2023-10-07



RSD-S-PLC WIRING DIAGRAM



WORKING SCHEMATIC DIAGRAM



ORDERING INFORMATION

415002	1500V UL, 1.2m cable, Stäubli MC4 PV-KBT4&KST4
415001	1000V UL, 1.2m cable, Customized connector



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REV3.0 2023-10-07

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MO# E-16897



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MO CONFERENCE OF THE UNITED METHODIST CHURCH

3601 AMRON CT.
COLUMBIA, MO, 65202

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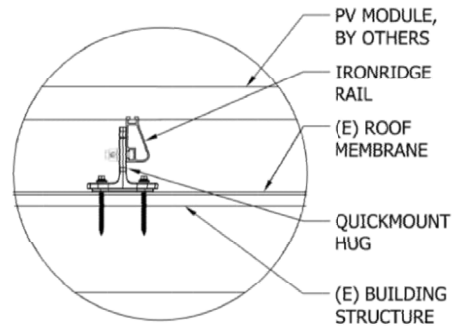
1501 CREEKWOOD PKWY, STE 110, COLUMBIA, MO, 65202-4287
573-447-6527 info@dogwoodsolar.com

COMBINER DATASHEET

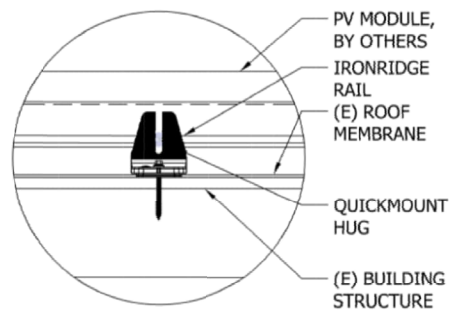
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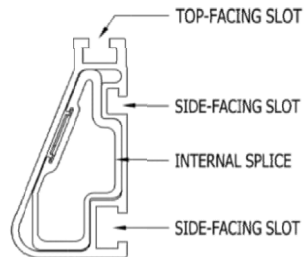
PV-7.3



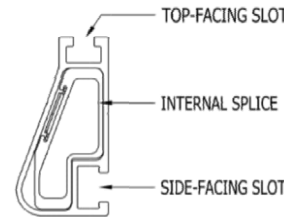
H HUG RAFTER DETAIL
Scale: 3"=1'-0"



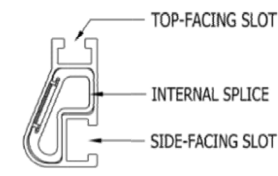
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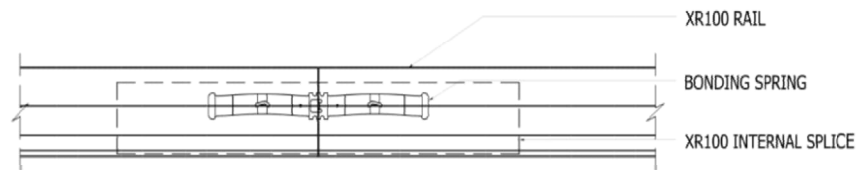
M DETAIL, SPLICE, XR1000
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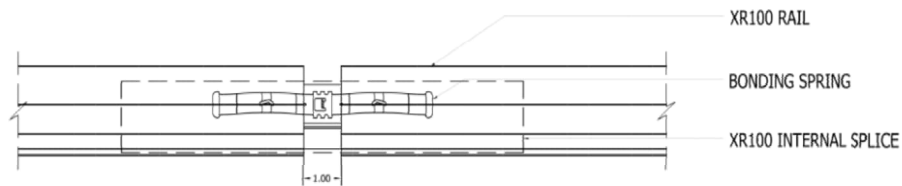
N DETAIL, SPLICE, XR100
1'-0"=1'-0"



O DETAIL, SPLICE, XR10
1'-0"=1'-0"



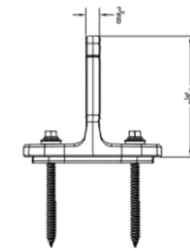
K DETAIL, SPLICE CONNECTION, XR100
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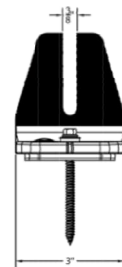
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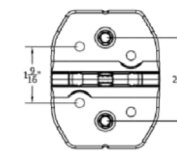
Q QUICKMOUNT HUG RAFTER



P QUICKMOUNT HUG RAFTER, SIDE VIEW

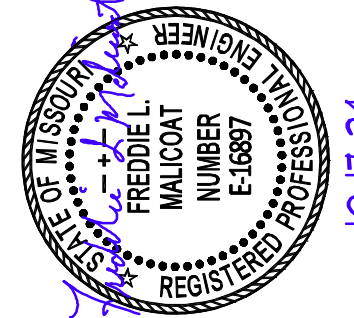


R QUICKMOUNT HUG RAFTER, FRONT VIEW



S QUICKMOUNT HUG RAFTER, PLAN VIEW

FREDDIE L. MALICOAT - ENGINEER
MO# E-16897



**MALICOAT - WINSLOW
ENGINEERS, INC.**

MISSOURI STATE CERTIFICATE OF AUTHORITY #000421

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DATE: 10-17-24
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REV #1:
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REV #3:

PV-7.4

Interconnection and Net Metering Application Guidelines

The installation of solar systems is a growing industry in Columbia and throughout the country. The installation of solar is a multi-step process that involves multiple Departments and Divisions of City government. These guidelines are in reference to the review and approval of the Net Metering Agreement, along with Utility Services Division's involvement in the processing of the associated rebates. Other Departments and Divisions of the City that are necessary for the full process may be mentioned, however, these guidelines do not supersede the requirements of other Departments and Divisions.

I. Definitions

- Columbia Building and Site Development (BSD) - The department within the City of Columbia responsible for building permits.
- Columbia Water and Light (CWL) - The electric utility provider for the generating facility.
- Generating Facility (GF) - The solar powered generating equipment owned and operated by the customer.
- Net Metering Agreement (NMA) - The Interconnection and Net Metering Agreement between the Generating Facility and Columbia Water and Light.
- Net Metering and Easy Connection Act (ECA) - The State of Missouri Statute (386.890.RSMo) for the interconnection and net metering of renewable energy systems up to 100 kilowatts.
- System Advisor Model (SAM) - The solar modeling program developed by the National Renewable Energy Laboratory.

II. Net Metering Process for Generating Facilities

A. Interconnection and Net Metering Agreement

1. Prior to the GF being able to be connected to CWL infrastructure, the NMA is needed between CWL and the property owner or the authorized agent.
 - a. For residential, the customer must be listed on the account in CIS or listed as the recorded property owner by the Boone County Assessor.
 - b. For commercial, the customer will be determined on a case by case basis by the CWL.
 - c. The NMA should be done prior to the GF being installed. The installation of a GF does not guarantee connection to the CWL infrastructure, unless all conditions given in Section II, Subsection B are met and the NMA is approved by CWL.
2. CWL will provide a letter to the customer approving the NMA when conditions in Section II, Subsection B have been met.
3. The customer will need to complete an electrical permit through BSD for the GF.
4. Upon completion of the electrical permit with BSD, CWL will review the installed GF for alignment with approved NMA. Any alterations will be handled on a case by case basis at the discretion of CWL.
5. Once the installed system has been reviewed and determined by CWL to comply with the NMA, a new bi-directional meter will be installed. CWL will not turn on the PV system at the time when the bi-directional meter is installed.

6. After the bi-directional meter is installed, the customer and/or installing contractor will be notified that the GF can be connected to the CWL infrastructure. CWL will not turn on the GF for its initial connection to the CWL Infrastructure.
7. If the planned PV system is greater than 100 kW, refer to Section V.

B. Net Metering Conditions

1. All of the conditions in the NMA will be met.
2. The NMA will be signed by the customer.
3. GF projected yearly PV generation cannot be greater than 110 percent of previous 3-year average of electric usage, as calculated by CWL. If the property is new or there is not adequate prior usage, discretion on oversizing will be made on a case by case basis by CWL.
4. Plans for the PV system are provided to CWL must be certified from a professional electrician or professional engineer. Professional electricians and/or engineers must be a Master Electrician that is licensed by the City of Columbia, a licensed Missouri Electrical Contractor from the Missouri Division of Professional Registration, or a Professional Engineer licensed in Missouri to comply with the ECA.
 - a. The plans must be provided directly from, be stamped by, or be accompanied by a signed statement from the professional electrician or engineer.
 - b. If the plans are not stamped, then a copy of the license or other proof of certification must be provided to CWL.
5. If a Line-Side Connection is used to connect the GF to the CWL infrastructure, see Attachment 1.
6. The solar disconnect must be within 6 feet and direct line of site of the electric meter base.
7. The solar modules and inverters for the GF must be new and listed as eligible solar energy equipment by the California's Energy Commission's Solar Equipment Lists. (<https://www.energy.ca.gov/programs-and-topics/topics/renewable-energy/solar-equipment-lists>)
8. CWL may require a meter base upgrade along with any PV installation.
 - a. Refer to Attachment 2 for additional requirements on meter base replacement.
 - b. If a meter base upgrade is necessary, the bi-directional meter will not be installed until the upgrade is completed.
 - c. The cost for the meter base upgrade is the responsibility of the customer.
9. The installation of a bi-directional meter is necessary before the GF can be connected to the CWL infrastructure. The bi-directional meter installation cost will be covered by CWL, given no installation limitations from the existing meter base. The bi-directional meter will not be installed until all associated project documentation is received, including but not limited to documentation for rebates.
10. PV systems with battery backup will be evaluated on a case by case basis by CWL for connection with City infrastructure.
11. The use of System Advisor Model (SAM) may be requested at the discretion of CWL review staff as part of the NMA for GF with significant potential reduction in solar production due to shading. CWL has a specific template that must be used in SAM. This template will be provided upon notification by CWL that a SAM is required for a GF. When SAM models are requested by CWL review staff, the shade analysis

must be used in the SAM model of the GF using the CWL SAM template. There are two options when performing a shade analysis:

- (1) The Solar Pathfinder tool and Solar Pathfinder Assistant software can be used to create a shade model to be exported and used in SAM.
- (2) The 3D Shade Calculator built into SAM may be used to create a shade model.

12. Any exceptions to the conditions listed above in this subsection may be reviewed on a case by case basis by CWL upon request.

III. Rebates for Generating Facilities

A. Rebate Requirements

1. Rebate for a GF is based on the total capacity (kW) at the utility peak and the modeled 1st year annual energy production (kWh).
2. CWL will only provide a rebate for the capacity needed to meet up to 110 percent of the customer's annual consumption.
3. CWL will only provide a rebate for GF that have electric meter bases associated with buildings on a fixed foundation.
4. Rebates will be capped at a maximum of \$50,000, regardless of GF system size.
5. GF with arrays that do not qualify for rebates are eligible for interconnection and net metering.

B. Rebate Calculation and Payment

1. For rebate structure and calculation refer to Attachment 4.
2. Once the installation of the GF is completed, an invoice must be provided to process the rebate. The following information is necessary on the invoice: on company letterhead, have an invoice number, have a date of issuance, have a due date, have the customer's name, have the address for the GF, and have a project description with a breakdown of items the customer received.

IV. Change in Ownership

Per the ECA, if there is a change in ownership of GF, the new owner shall be responsible for filing a new NMA with CWL.

V. Generating Facilities Greater than 100 kW

For any GF greater than 100 kW, these will be handled on a case by case basis with CWL.

VI. Solar Water Heaters

A. No rebates are available for the installation of solar water heaters.

Line-Side AC Connections for PV Systems

NEC Article 240.21(B)(1) through (B)(5), regulates wire and over-current protection for feeder taps.

NEC Article 690.64(A) allows a Line-Side AC connection to busbars, conductors, or lugs at any point between the customer's side of the utility meter, and the service disconnect.

NEC Article 750.12 specifies how the output of interconnected power sources shall be connected. City of Columbia Utilities does not allow the line side AC connection to be made within the meter base.

A separate junction box must be supplied. See Figure 1.

Contractors must connect to the service entrance conductors, busbars, or lugs at some point between the customer's side of the meter, and the main service disconnect. Busbar connectors often make this easy with ready-made connection points you simply bolt up to, but other devices for conductor attachments are allowed. These are insulation-piercing tap splice connectors, insulated terminal blocks, parallel tap connectors, crimped parallel connectors, and the split bolt.

Meter base sizing must be verified prior to interconnection approval. Water & Light may require a meter base upgrade along with any PV installation.

Contractors are responsible for paying the meter removal/replacement fee for this type of connection.

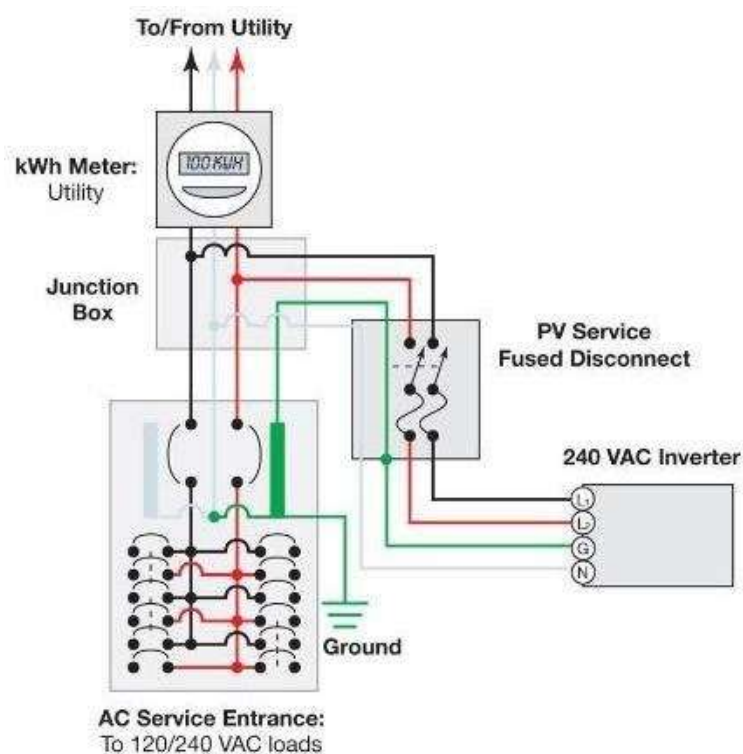


Figure 1. Diagram of allowable Line-Side Connection.

Columbia Water and Light Solar Installation Meter Base Replacement

All meter bases installed in CWL's service territory shall be of a type approved by CWL and meet all requirements in construction and features. It is necessary for the protection of the customer that all electrical work be installed and maintained in a safe manner by a licensed electrician. In addition, meter sockets purchased by the customer shall be:

- UL listed
- Labeled in accordance with National Electrical Code
- Have a lever operated by-pass device
- Be a minimum of 200 amps

Meter bases installed prior to 1980 must be replaced unless it can be verified that they meet the following criteria:

1. Meter base is properly sized for the work to be completed.
 - 60 amp meter bases shall be replaced
 - 100 amp meter bases that are small square meter bases flush with the siding on the house shall be replaced on all GF
 - 100 amp meter bases shall be replaced if the solar system is 15 kW or larger
 - Size/rating of service entrance conductors shall be evaluated for replaced meter bases
2. Meter base is in good condition, as determined by CWL (including but not limited to):
 - Meter base is properly secured to building
 - No missing knockouts
 - Minimal signs of rust
 - No evidence of burning or arcing
 - Overhead mast is securely fixed
 - Underground conduit is sealed and securely fixed
3. A residential property with current transformer meter bases will require a meter base replacement. Commercial properties with current transformer meter bases will be reviewed on a case by case basis.
4. Meter base is appropriate for a bi-directional meter.

**Code Requirements for
Residential and Commercial
Solar Photovoltaic Systems**

Applicable Building Codes:

- IRC 2018 International Residential Code R324.3.1 through R324.7.1
- NEC 2017 National Electric Code (Article 690, NFPA 70 and all other applicable standards)
- IRC 2018 International Residential Code Stationary Storage Battery Systems R327.1 through R327.6

Building Code Questions:

Contact: Columbia Building and Site Development

573-874-2489

<https://www.como.gov/community-development/bsd/building-permits/>

Apply for a Permit:

Online: https://energov.como.gov/energov_prod/selfservice#/home

Over the Phone: 573-874-7474

Solar Rebate Structure and Calculation

The rebate paid for a PV system is based on the total capacity (kW) and modeled energy production. Water & Light will only provide a rebate for the capacity needed to meet up to 110% of the customer's annual consumption. Annual consumption is an average of the most recent 3 years consumption at the installation location. Systems with a tilt greater than 10 degrees from horizontal and azimuths ranging from 0 – 70 and 320 – 0 **are not eligible for rebates**. However, these systems are eligible for interconnection and net metering.

Step 1. System size: To determine the dollar value of the Baseline Rebate, multiply the total capacity (kW) by \$500.

Step 2. The rebate calculator worksheet (partially shown below) will be used to determine the rebate based on the system size and orientation (azimuth and tilt). The worksheet can be downloaded from the City website, and the rebate for each array will be automatically calculated. The Peak Factor for each azimuth and tilt combination that is eligible for rebate can be seen on the full chart.

Site specific conditions, such as shading, may cause a significant potential reduction in solar production due to shading. This will affect the Peak Factor used in determining the final rebate amount and CWL may request shading analysis. If shading analysis is requested the solar vendor/contractor is required to complete and submit modeling of the solar array using the National Renewable Energy Laboratory's System Advisor Model (SAM) software (<https://sam.nrel.gov/>) using the CWL template and a shade analysis. This modeling will provide production characteristics specific to the solar array design features. Contractors should contact Columbia Water & Light for the required conditions to model a system's output. System output is expressed in terms of first year annual solar production (kWh generated). Systems containing arrays with multiple tilt, azimuth and shading conditions must be modeled separately. Rebate will decrease proportionally based on the reduced annual production with shading incorporated versus the annual production without shading analysis.

Water & Light reserves the right to verify modeled output at any time.

Step 3. Enter parameters into the rebate calculator worksheet to automatically determine the anticipated rebate. Each array will need to be entered separately.

If SAM modeling is required, instructions on how to determine the rebate will be provided by CWL.

For Single Array: $\text{Baseline Rebate} \times \text{Peak Factor} = \text{Rebate Amount}$

Multiple Arrays: Complete Single Array Calculation for each array and sum rebate amounts

Chart #1, Portion of rebate calculator chart appended to display Peak Factor values associated with Azimuth values of 0-140 and Tilt values of 0 - 21

TILT	AZIMUTH																												
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1
11																0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1
12																0.9	0.9	1	1	1	1	1	1	1	1	1	1	1	1
13																0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1
14																0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1	1.1
15																0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	1.1	1.1
16																0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1.1	1.1
17																0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1.1	1.1
18																0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1.1	1.1
19																0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1.1	1.1	1.1
20																0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1.1	1.1	1.1
21																0.9	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1.1	1.1	1.1

Sample Calculation

Total System Size: 12 kW
 Tilt: 20 degree
 Azimuth: 135 degree orientation

Baseline rebate: 12 kW * \$500/kW = \$6,000
 Peak Factor: 1.1 (From rebate calculator)
 Rebate amount: (6,000 * 1.1) = \$6,600

Questions

Email: Renewables@CoMo.gov

Phone: 573.441.5528