

SOLAR ELECTRIC SYSTEM FOR MEXICO SCHOOL VOCATIONAL CENTER



SOLAR SOLUTIONS

1617 Main St.
Kansas City MO, 64108
PH. (816) 866-0555

PROJECT INFORMATION:

**MEXICO SCHOOL
VOCATIONAL
CENTER**
24.705 PV System

1000 N. WADE ST.
MEXICO, MO 65265

ISSUE DATE:

02/04/2014

REV: _____ DATE: _____ BY: _____

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ENGINEER:

GERALD CHARLTON, P.E.
BRIGHTERGY, LLC
1617 MAIN STREET 3RD FLOOR
KANSAS CITY, MO 64108
PH. 816-866-0555

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SHEET TITLE:

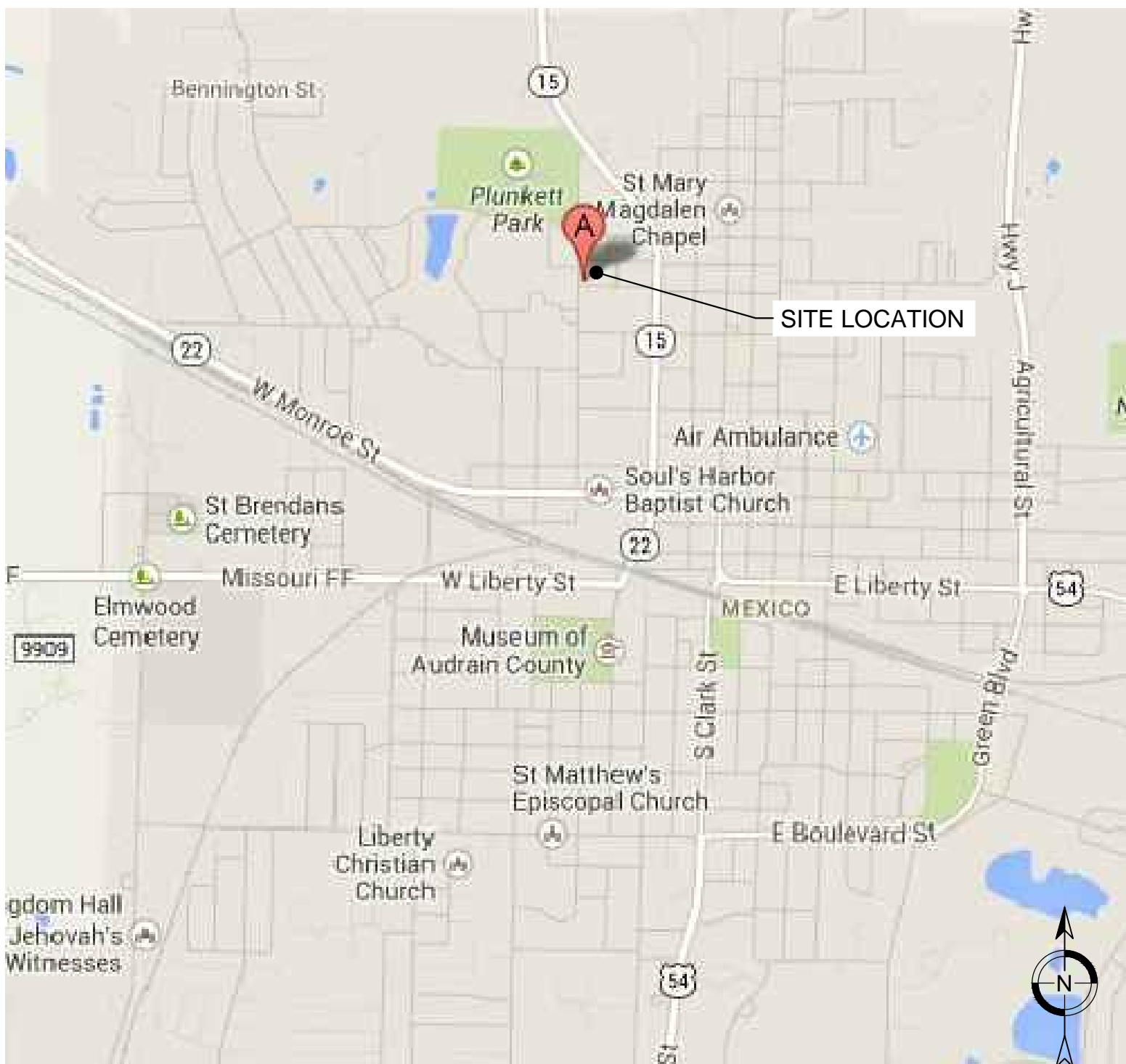
**TITLE
SHEET**

SHEET NUMBER:

T1



VICINITY MAP



LOCAL MAP

SITE INFORMATION:

OWNER: MEXICO SCHOOL VOCATIONAL CENTER
1000 N. WADE ST.
MEXICO, MO 65265

CLIENT CONTACT: BRIGHTERGY, LLC
1617 MAIN ST.
KANSAS CITY, MO 64108

UTILITY COMPANY: AMEREN
ACCOUNT NUMBER: 00500-09514
METER NUMBER: 09602075

CONTACT INFORMATION:

PROPERTY REPRESENTATIVE: KEVIN FREEMAN
(573) 581-3773

PROJECT MANAGER: MIKE RIEHL - BRIGHTERGY, LLC
(314) 473-1545

GENERAL EXECUTIVE: LISA COSGROVE
AMEREN MISSOURI (314) 554-2649

SHEET INDEX:

- T1 TITLE SHEET
- ST1 SITE PLAN
- E1 ELECTRICAL LAYOUT
- E2 ELECTRICAL DETAILS
- E3 ELECTRICAL LINE DIAGRAM
- E4 NEC REQUIRED LABELS
- S1 RACKING LAYOUT
- S2 RACKING DETAIL

APPROVALS:

THE FOLLOWING PARTIES HEREBY APPROVE AND ACCEPT THESE DOCUMENTS AND AUTHORIZE THE CONTRACTOR TO PROCEED WITH THE CONSTRUCTION DESCRIBED HEREIN. ALL DOCUMENTS ARE SUBJECT TO REVIEW BY THE LOCAL BUILDING DEPARTMENT AND MAY IMPOSE CHANGES OR SITE MODIFICATIONS.

BRIGHTERGY: _____ DATE: _____

CONTRACTOR / LEAD INSTALLER: _____ DATE: _____

NOTE:

CONTRACTOR SHALL NOT COMMENCE WORK UNTIL A PERMIT AND INTERCONNECTION APPROVAL HAS BEEN OBTAINED WITH NO EXCEPTIONS



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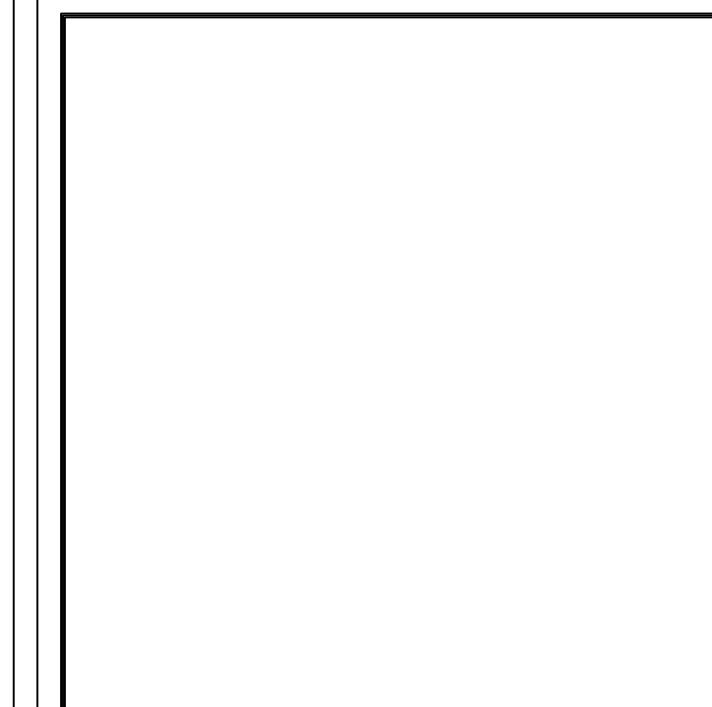
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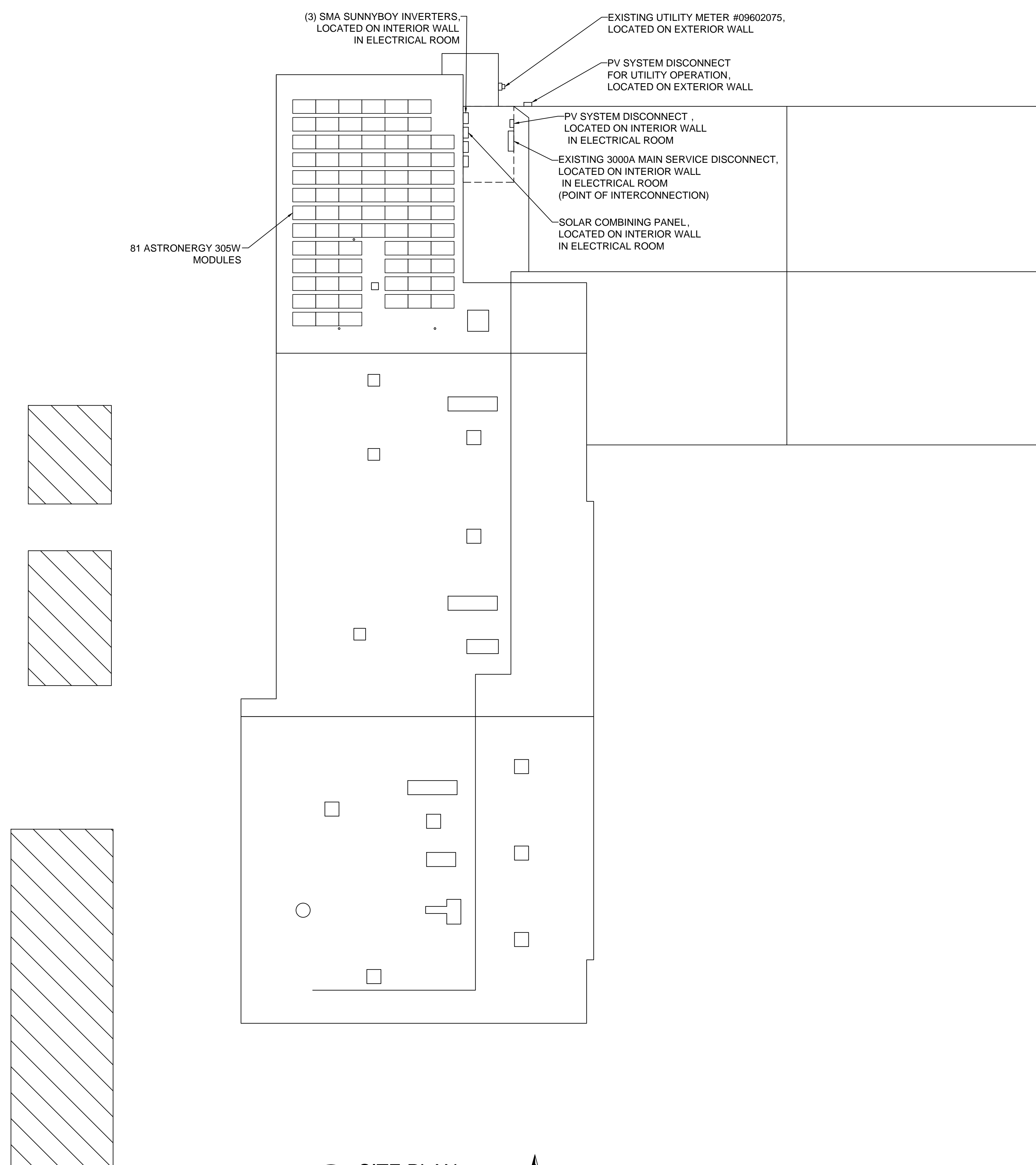


SHEET TITLE:

**SITE
PLAN**

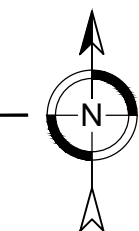
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ST1



N. WADE ST.

1 SITE PLAN
SCALE: 1/16" = 1'-0"





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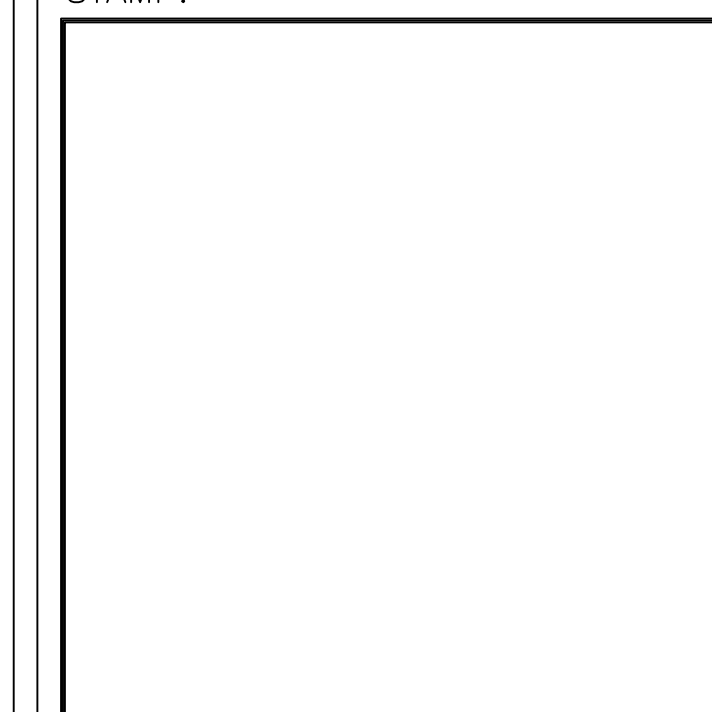
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ALM AJN MR

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SHEET TITLE:

**ELECTRICAL
LAYOUT**

SHEET NUMBER:

E1

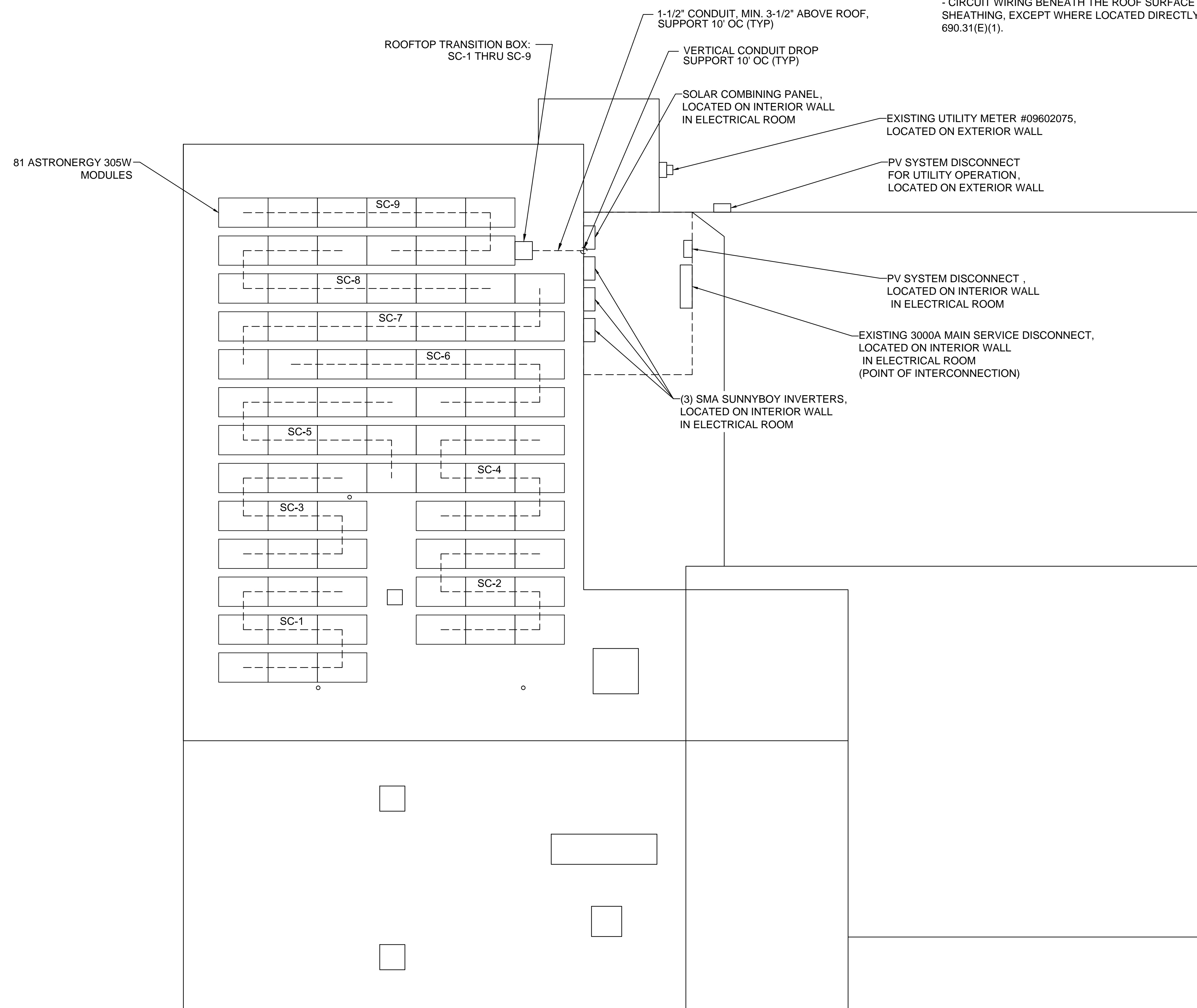
WIRING NOTES:

ROOF SURFACE:

- EXPOSED WIRING SHALL BE SUNLIGHT RESISTANT AND SECURED FIRMLY IN A CLEAN AND WORKMANLIKE MANOR.
- SURFACE CONDUIT CONNECTING SUB ARRAYS CONTAINING SOURCE CIRCUIT HOME RUN WIRES, SHALL BE 1" IN SIZE AND NOT CONTAIN MORE THAN (6) #10AWG CONDUCTORS AND (1) #6AWG BARE COPPER GROUND.
- CONDUIT SHALL BE SUPPORTED EVERY 10' O.C., MINIMUM OF 3-1/2" ABOVE ROOF SURFACE, AND ROUTED ALONG WALLS AND PARAPETS TO MINIMIZE SUN EXPOSURE AND TRIP HAZARDS.

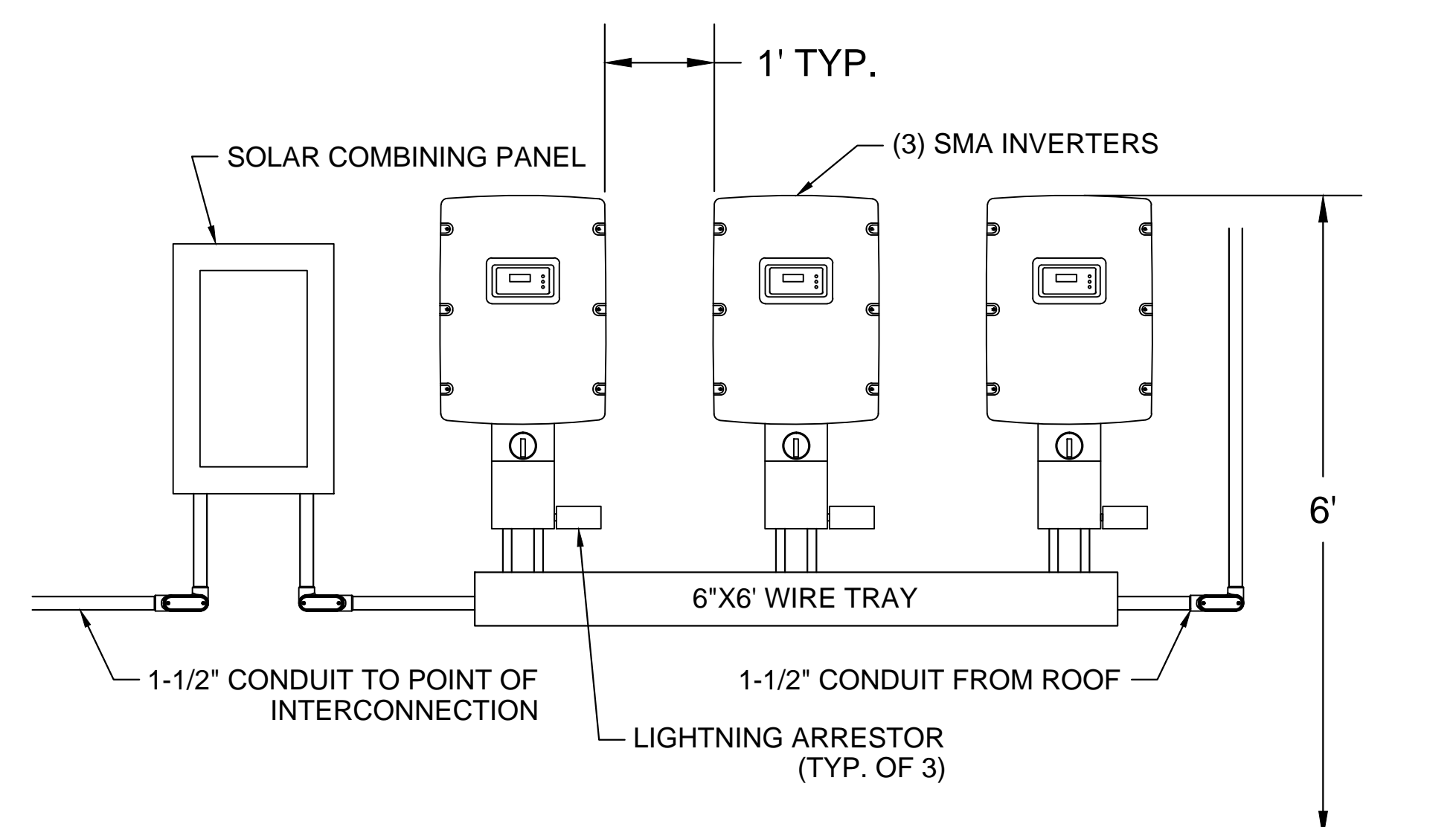
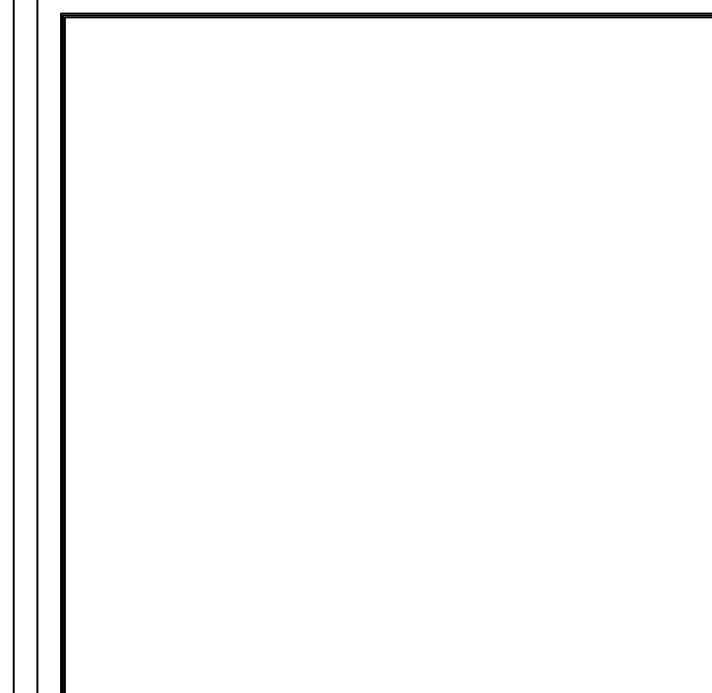
BUILDING INTERIOR:

- WIRING SHALL BE CONTAINED IN METAL RACEWAYS, TYPE "MC" METAL-CLAD CABLE, THAT PROVIDES AN EFFECTIVE GROUND-FAULT CURRENT PATH PER NEC 250.118(10).
- CIRCUIT WIRING BENEATH THE ROOF SURFACE SHALL NOT BE INSTALLED WITHIN 10" OF THE ROOF DECKING OR SHEATHING, EXCEPT WHERE LOCATED DIRECTLY BELOW THE ROOF SURFACE COVERED BY PV MODULES PER NEC 690.31(E)(1).



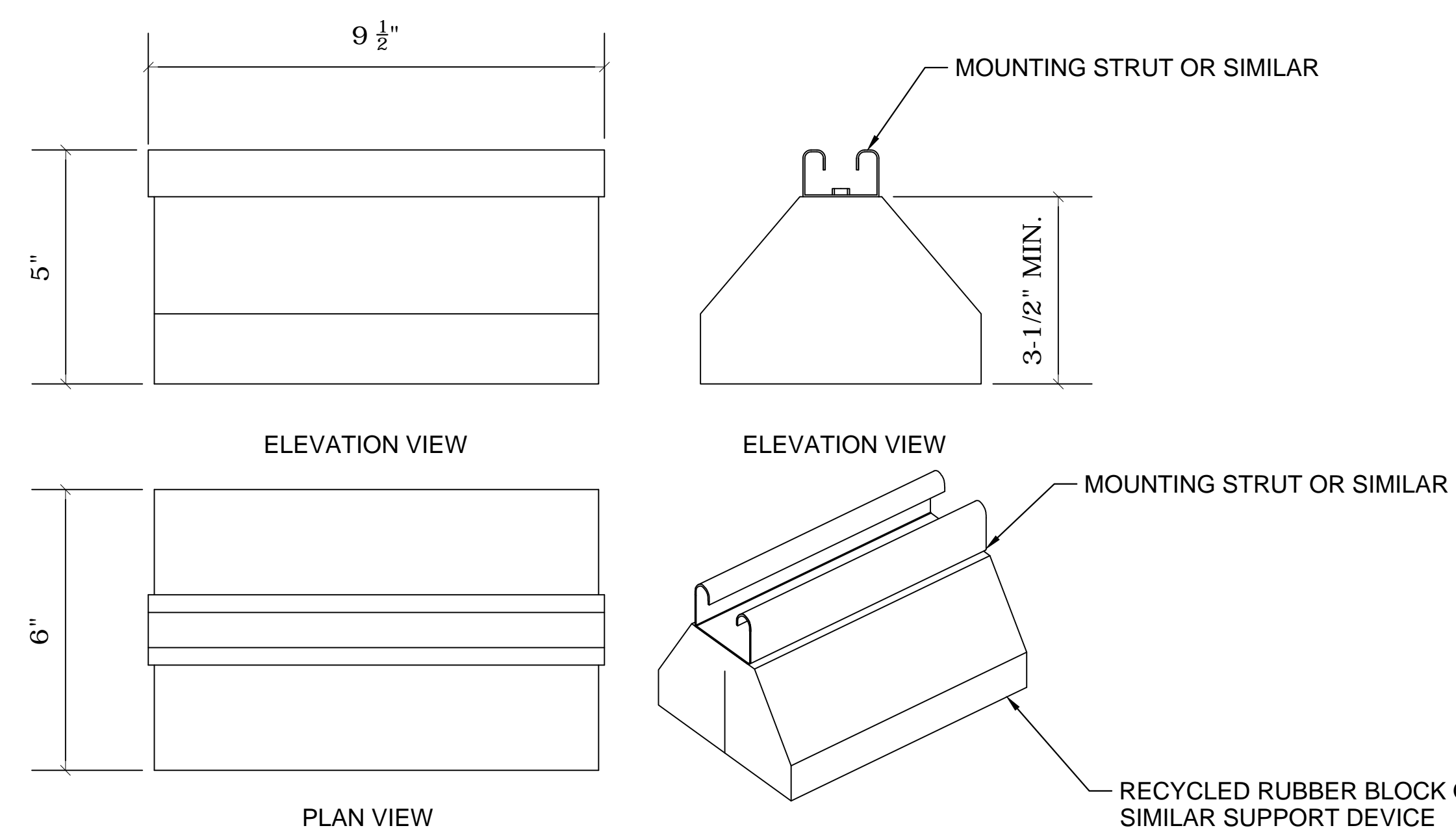
1 ELECTRICAL LAYOUT
SCALE: 1/8" = 1'-0"

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1 EQUIPMENT ELEVATION

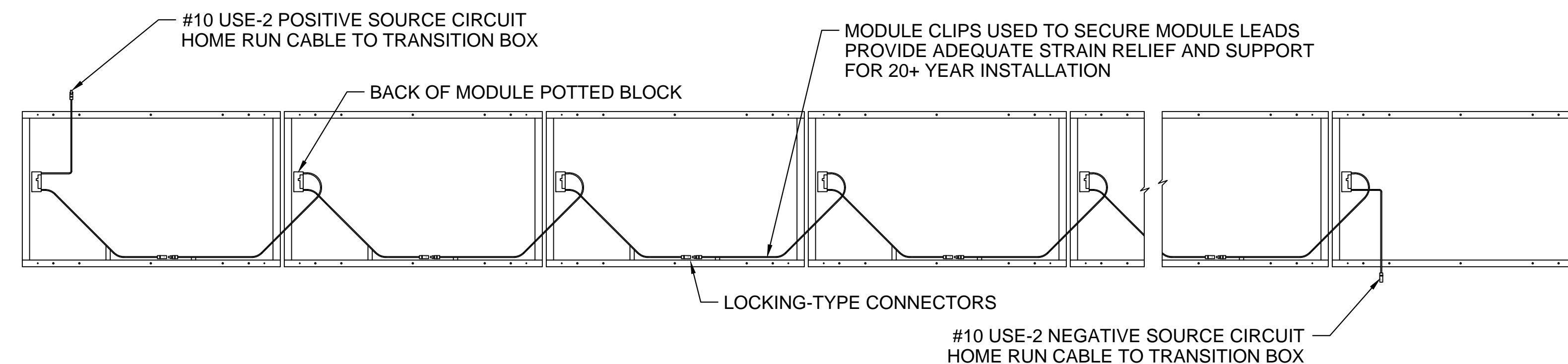
SCALE: 3/4" = 1'-0"



5 CONDUIT SUPPORT DETAIL

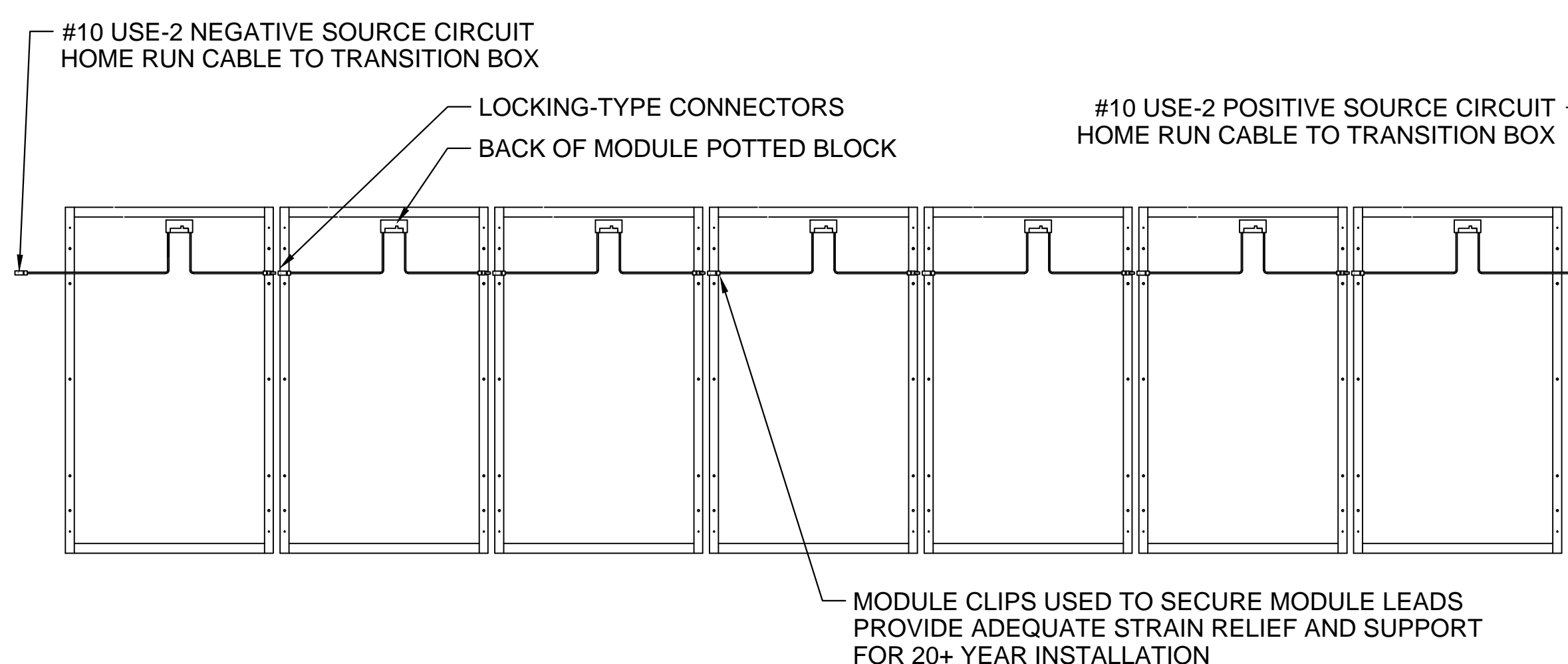
NTS

NOTE: PROVIDE QUANTITY AS REQUIRED TO SUPPORT EXTERNAL CONDUIT



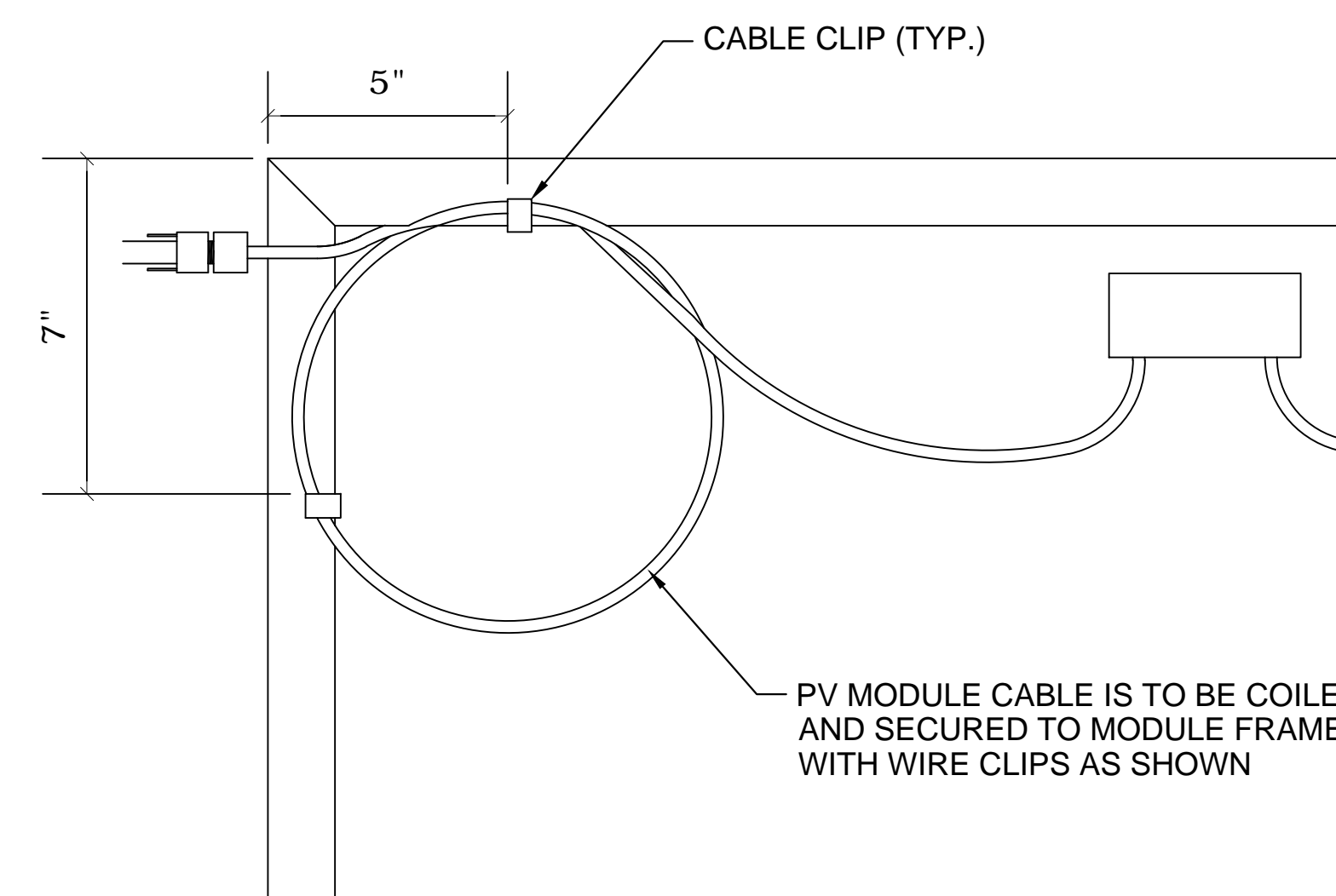
2 PV STRING WIRING DETAIL

NTS



3 PV STRING WIRING DETAIL

NTS



4 PV WIRE MANAGEMENT DETAIL

NTS

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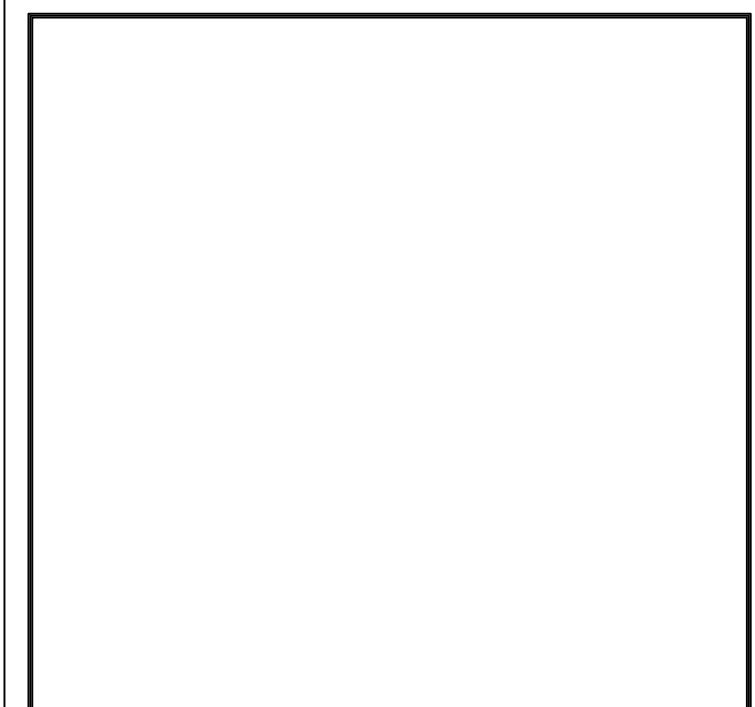
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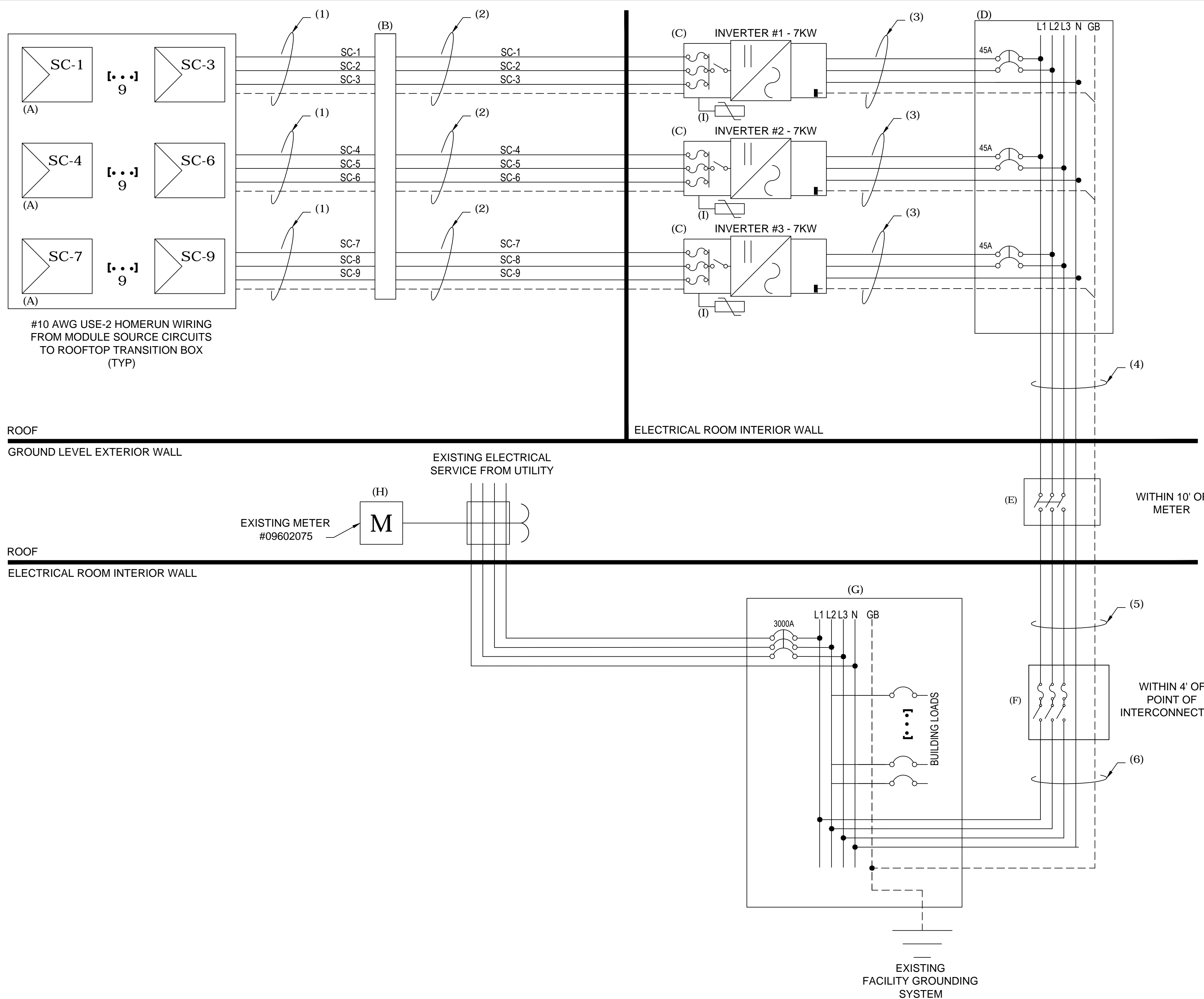


SHEET TITLE:

ELECTRICAL LINE DIAGRAM

SHEET NUMBER:

E3



| SITE CONDITIONS: | |
|--|---------------|
| LOCATION: | MEXICO, MO |
| MAX AVG. TEMP: | 37°C |
| EXTREME MIN TEMP | -20°C |
| **INFO OBTAINED FROM ASHRAE** | |
| PV ARRAY CONFIGURATION: | |
| MODULE MFR.: | ASTRONERGY |
| MODULE MFR. MODELS: | CHSM6612P-305 |
| MODULES PER SOURCE CIRCUIT: | 9 |
| TOTAL SOURCE CIRCUITS: | 9 |
| TRANSITION BOX QTY.: | 1 |
| PV MODULE OUTPUT FOR ASTRONERGY CHSM6612P-305* | |
| VOC: | 45.29 Vdc |
| TEMP. COEFFICIENT OF Voc | -0.322 %/°C |
| ISC | 8.95 Adc |
| VMP | 35.77 Vdc |
| IMP | 8.53 Adc |
| PV SOURCE CIRCUIT OUTPUT FOR SC-1 THRU SC-9* | |
| VOC: | 407.6 Vdc |
| TEMP. ADJUSTED | 469.3 Vdc |
| ISC | 8.95 Adc |
| VMP | 321.3 Vdc |
| IMP | 8.53 Adc |
| INDIVIDUAL 7KW INVERTER OUTPUT | |
| TYPE* | SMA SB 7000US |
| RATED POWER: | 7.0 KWac |
| OPERATING AC VOLTAGE: | 208 Vac |
| MAX. CURRENT: | 34 Aac |
| OUTPUT FREQUENCY | 60 Hz |
| *BASED ON MODULE PERFORMANCE AT STANDARD TEST CONDITIONS (STC) | |

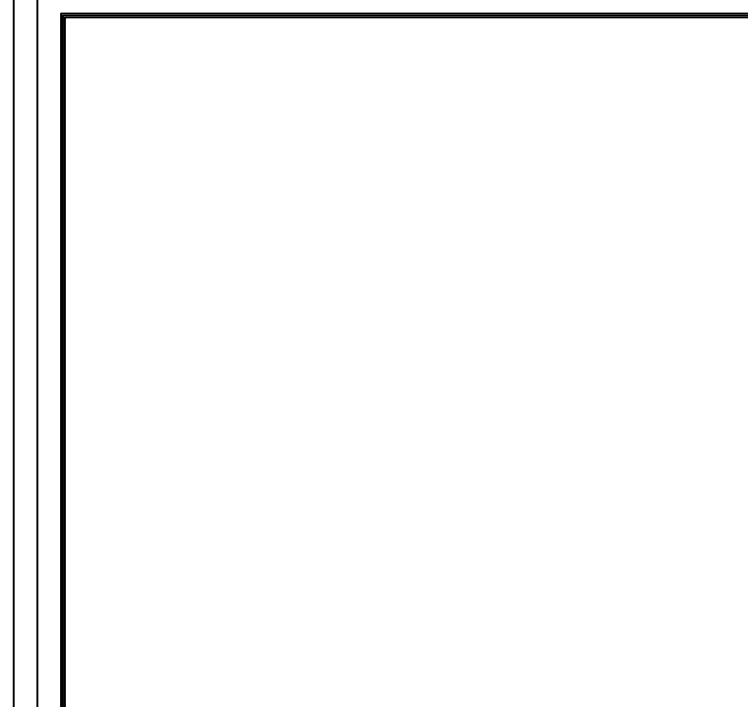
| ID | DESCRIPTION | QTY |
|-----|--|-----|
| (A) | ASTRONERGY CHSM6612P-305 (305W) MODULES, NEGATIVE GROUNDED | 81 |
| (B) | TRANSITION BOX, SIZE: 12"x12"x6", NEMA 4, ADJACENT TO ARRAY | 1 |
| (C) | SMA SUNNYBOY 7.0 kW UTILITY INTERACTIVE DC-TO-AC INVERTER: 1-PHASE, 3-WIRE, 208 VAC, NEMA 3R W/ INTEGRAL DC COMBINER | 3 |
| (D) | SOLAR COMBINING PANEL: 225A, 208V, 3-PHASE, NEMA 3R | 1 |
| (E) | PV SYSTEM DISCONNECT FOR UTILITY OPERATION: 100A, 250V, NEMA 3R | 1 |
| (F) | PV SYSTEM DISCONNECT: 100AT, 80AF, 250V, NEMA 1 | 1 |
| (G) | EXISTING MAIN DISTRIBUTION PANEL : 3000A, 208V, 3-PHASE, 4-WIRE | 1 |
| (H) | EXISTING BILLING METER TO BE SWAPPED AFTER UTILITY INSPECTION | 1 |
| (H) | LIGHTNING SUPPRESSOR(S) - PART #LA602 (DC) | 3 |

- NOTES**
- ALL HOMERUN WIRES TO TRANSITION BOXES ARE #10 AWG USE-2/RHW-2 DUAL RATED WIRES. ROUTED AS REQUIRED.
 - ALL CONDUIT TO BE EMT, UNLESS OTHERWISE SPECIFIED BY LOCAL AHJ.
 - ALL EQUIPMENT TO BE LABELLED PER NEC REQUIREMENTS.
 - SYSTEM TO BE INSTALLED WITH ADEQUATE AC AND DC TRANSIENT VOLTAGE SURGE SUPPRESSION.
 - POINT OF INTERCONNECTION:
 - (A) LOAD SIDE: THE SUM OF THE AMPERE RATINGS OF OVERCURRENT DEVICES IN CIRCUITS SUPPLYING POWER TO A BUSBAR OR CONDUCTOR SHALL NOT EXCEED 120 PERCENT OF THE RATING OF THE BUSBAR OR CONDUCTOR. NEC 705.12(D)2.
 - (B) SUPPLY SIDE: THE SUM OF THE RATINGS OF ALL OVERCURRENT DEVICES CONNECTED TO POWER PRODUCING SOURCES SHALL NOT EXCEED THE RATING OF THE SERVICE. NEC 705.12(A).

| ID | MAX AMPERAGE | EST. MAX LENGTH | # OF WIRES | WIRE SIZE (AWG) | VOLTAGE DROP | GROUND SIZE | CONDUIT SIZE |
|-----|--------------|-----------------|------------|-----------------|--------------|-------------|--------------|
| (1) | 13.96 Adc | 90' | 6 | #10 USE-2 | | #6 | FREE AIR |
| (2) | 13.96 Adc | 70' | 6 | #10 THWN-2 | | #10 | 1-1/2" |
| (3) | 42.5 Aac | 10' | 3 | #8 THWN-2 | 0.23 | #8 | 1-1/2" |
| (4) | 73.5 Aac | 30' | 4 | #4 THWN-2 | 0.32 | #6 | 1-1/2" |
| (5) | 73.5 Aac | 30' | 4 | #4 THWN-2 | 0.32 | #6 | 1-1/2" |
| (6) | 73.5 Aac | 10' | 4 | #4 THWN-2 | 0.11 | #6 | 1-1/2" |

- * ALL DC CURRENTS ARE SHORT CIRCUIT VALUES.
- * ALL AC CURRENTS ARE NOMINAL PER-PHASE VALUES.
- * WIRE AMPACITY IS BASED ON NUMBER OF WIRES PER CONDUIT AND HEIGHT ABOVE ROOF. IF CONDUITS ARE INSTALLED DIFFERENTLY THAN SHOWN ABOVE WIRE SIZES MAY BE AFFECTED.
- * ALL CONDUCTORS ARE COPPER 90° C RATED.
- * DUAL RATED (THHN/THWN-2) CONDUCTORS ARE FAVORABLE.

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INVERTERS (3), AC DISCONNECT (1), MAIN DISTRIBUTION PANEL (1), SOLAR COMBINING PANEL (1), & TRANSITION BOX (1) SHALL REQUIRE THE FOLLOWING LABEL (7)

**AUTHORIZED PERSONNEL
ONLY**

- ①
- ②
- ③
- ⑤
- ⑥
- ⑧

THE UTILITY INTERACTIVE INVERTER(S) SHALL BE LABELED WITH THE FOLLOWING PER NEC ARTICLE 690.9(C) (3 REQUIRED)

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

- ①

THE DC COMBINERS / DC DISCONNECTS & AC DISCONNECTS SHALL BE LABELED WITH THE FOLLOWING PER NEC ARTICLE 690.14(C)(2) & 690.17 (4 REQUIRED)

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

- ①
- ⑤

THE PV DAS SHALL BE LABELED WITH THE FOLLOWING INFORMATION PER NEC ARTICLE 690.4(D) (1 REQUIRED)

**PHOTOVOLTAIC SYSTEM DATA
ACQUISITION SYSTEM
AUTHORIZED PERSONNEL ONLY**

AC COMBINING PANEL SHALL REQUIRE THE FOLLOWING LABELING (1 REQUIRED PER BRANCH CIRCUIT)

**SOLAR FED BREAKER
INVERTER #1**

- ②

**SOLAR FED BREAKER
INVERTER #2**

- ②

**SOLAR FED BREAKER
INVERTER #3**

- ②

PHOTOVOLTAIC SYSTEM INTERCONNECTION TO MDP & SOLAR COMBINING PANEL SHALL REQUIRE THE FOLLOWING LABELING 690.54 (2 REQUIRED)

**PHOTOVOLTAIC INTERACTIVE SYSTEM
POINT OF INTERCONNECTION**
OPERATING AC VOLTAGE: 208Vac, 3-PHASE
RATED AC OUTPUT CURRENT: 58.8Aac

- ②
- ③

PHOTOVOLTAIC SYSTEM AC DISCONNECTS SHALL REQUIRE THE FOLLOWING LABELING 690.14(C)(2) & 690.54 (1 REQUIRED)

PHOTOVOLTAIC SYSTEM AC DISCONNECT
OPERATING AC VOLTAGE: 208Vac, 3-PHASE
MAXIMUM OPERATING CURRENT: 58.8Aac

- ⑤

**INVERTER #1
GRID TIED PHOTOVOLTAIC POWER SOURCE**
1) MAXIMUM POWER-POINT CURRENT: 25.59Aac
2) MAXIMUM POWER-POINT VOLTAGE: 321.3Vdc
3) MAXIMUM SYSTEM VOLTAGE (ADJUSTED): 461.1Vdc
4) SHORT CIRCUIT CURRENT (ADJUSTED): 33.56Aac

- ①

**INVERTER #2
GRID TIED PHOTOVOLTAIC POWER SOURCE**
1) MAXIMUM POWER-POINT CURRENT: 25.59Aac
2) MAXIMUM POWER-POINT VOLTAGE: 321.3Vdc
3) MAXIMUM SYSTEM VOLTAGE (ADJUSTED): 461.1Vdc
4) SHORT CIRCUIT CURRENT (ADJUSTED): 33.56Aac

- ①

**INVERTER #3
GRID TIED PHOTOVOLTAIC POWER SOURCE**
1) MAXIMUM POWER-POINT CURRENT: 25.59Aac
2) MAXIMUM POWER-POINT VOLTAGE: 321.3Vdc
3) MAXIMUM SYSTEM VOLTAGE (ADJUSTED): 461.1Vdc
4) SHORT CIRCUIT CURRENT (ADJUSTED): 33.56Aac

- ①

UTILITY BILLING METER, POINT OF INTERCONNECTION (& MDP, IF SEPARATE), AC COMBINING PANEL, & MAIN PV DISCONNECT SHALL RECEIVE A PERMANENT LABEL, DENOTING ALL ELECTRICAL POWER SOURCES PER NEC ARTICLE 705.12(D)(4) & 705.10 (4 REQUIRED)

**EQUIPMENT FED BY TWO SOURCES:
UTILITY AND PHOTOVOLTAIC SYSTEM,
WITH PV PANELS ON ROOF, AND
INVERTERS LOCATED ON INTERIOR WEST
WALL OF ELECTRICAL ROOM**

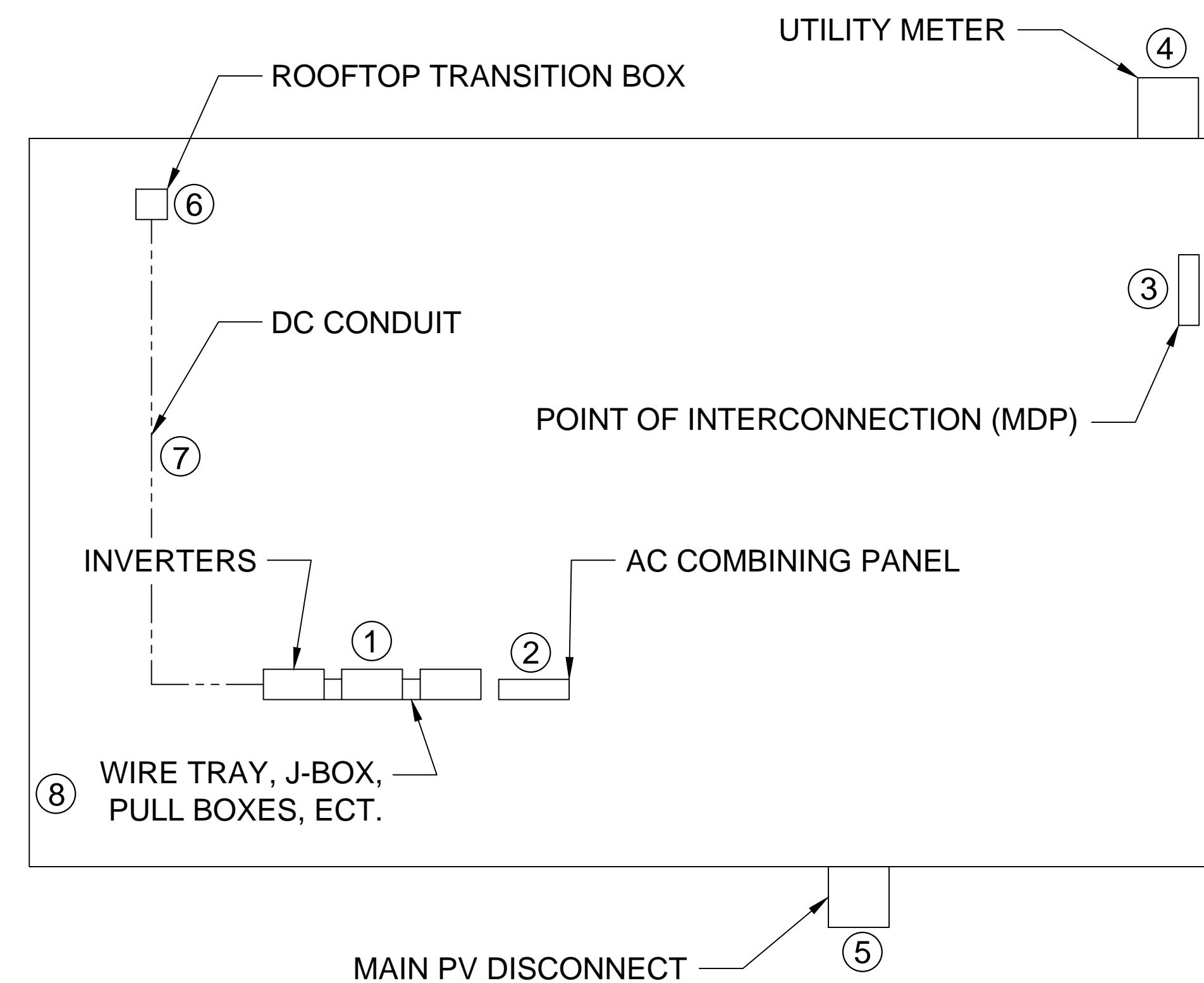
- ②
- ③
- ④
- ⑤

UTILITY ACCESSIBLE DISCONNECT SHALL RECEIVE A PERMANENT ENGRAVED PLAQUE, 3/8" MIN. LETTERING, PER UTILITY REQUIREMENTS (1 REQUIRED)

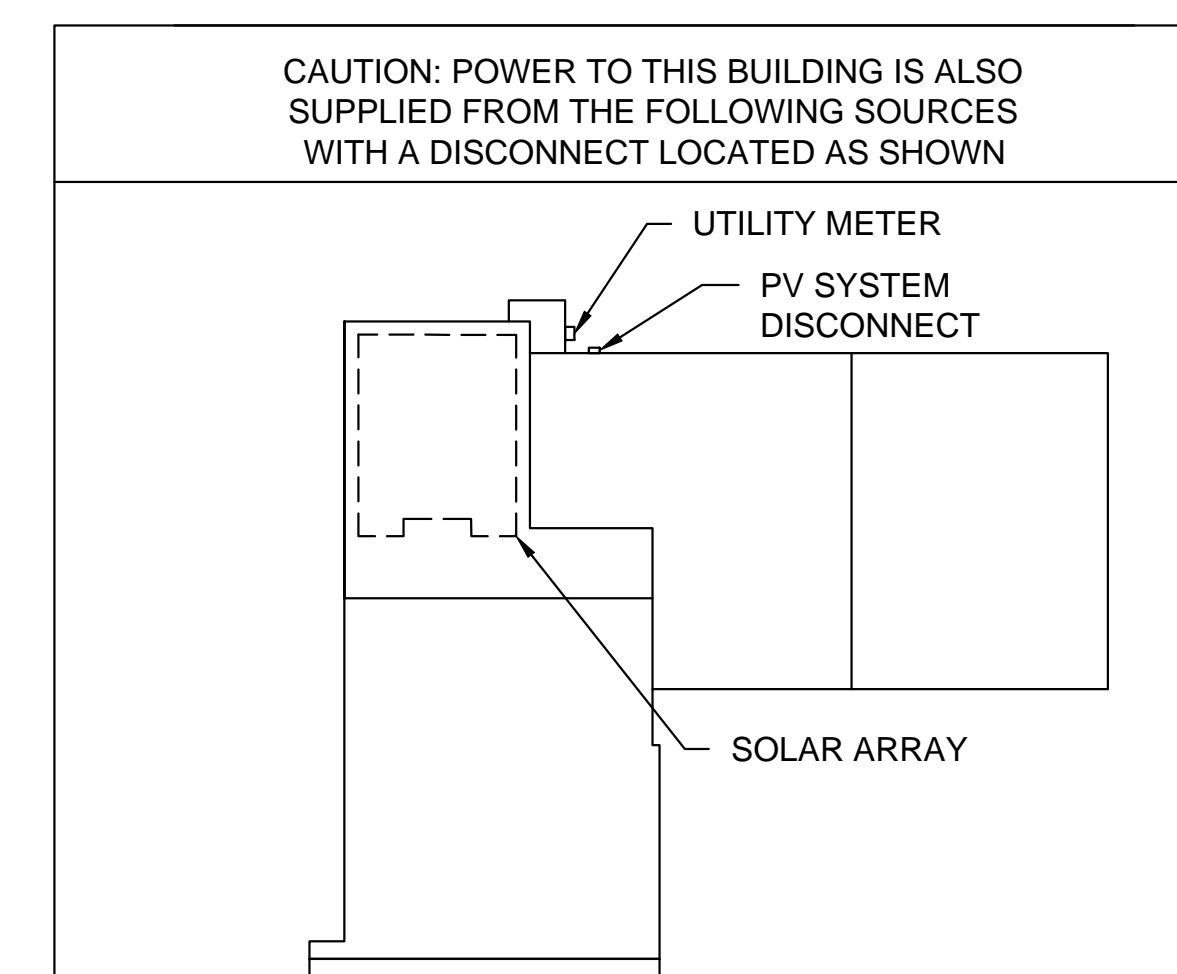
**PV SYSTEM DISCONNECT
FOR UTILITY OPERATION**

- ⑤

****SAMPLE LAYOUT FOR REFERENCE ONLY****



A SITE DIRECTORY PLAQUE SHALL BE LOCATED ON OR BESIDE THE BI-DIRECTIONAL UTILITY BILLING METER PER NEC ARTICLE 705.10 (1 REQUIRED)



MARKING: 2012 INTERNATIONAL FIRE CODE (IFC) 605.11.1

- THE FOLLOWING LABEL IS REQUIRED ON ALL INTERIOR AND EXTERIOR DIRECT CURRENT (DC) CONDUIT, ENCLOSURES, RACEWAYS AND CABLE ASSEMBLIES EVERY 10 FEET, WITHIN 1 FOOT OF TURNS OR BENDS AND WITHIN 1 FOOT ABOVE AND BELOW PENETRATIONS OF ROOF/CEILING ASSEMBLIES, WALLS OR BARRIERS.

- LABELS ALSO REQUIRED ON ALL DIRECT CURRENT (DC) JUNCTION BOXES, COMBINER BOXES, AND DISCONNECTS.

- AN ADDITIONAL LABEL SHALL BE PLACED ADJACENT TO THE MAIN SERVICE DISCONNECT IN A LOCATION CLEARLY VISIBLE FROM THE LOCATION WHERE THE DISCONNECT IS OPERATED.

- MATERIAL SHALL BE REFLECTIVE, WEATHER RESISTANT AND SUITABLE FOR THE ENVIRONMENT. LETTERS SHALL BE CAPITALIZED WITH A MIN. HEIGHT OF 3/8" (9.5MM) WHITE ON RED BACKGROUND.

**WARNING:
PHOTOVOLTAIC POWER SOURCE**

- ⑥
- ⑦
- ⑧

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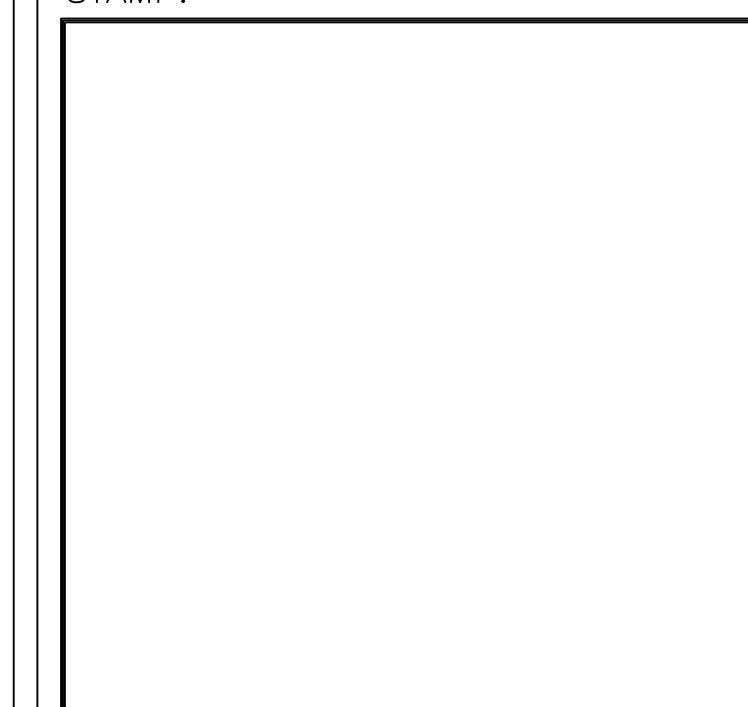
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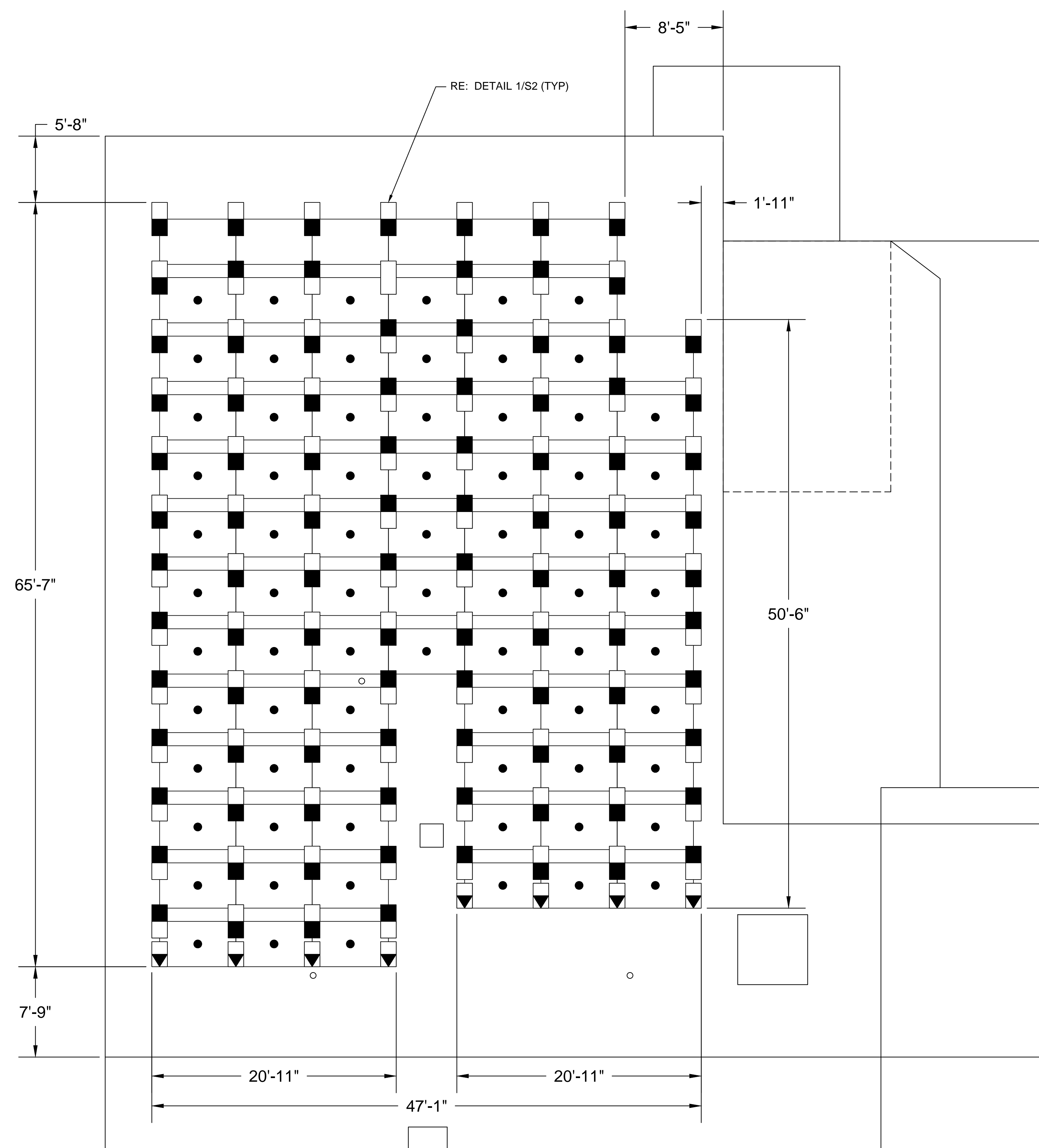


SHEET TITLE:

RACKING
LAYOUT


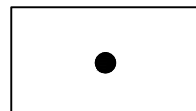
SHEET NUMBER:

S1



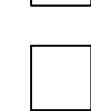



1 ROOF BALLAST PLAN
SCALE: 3/16" = 1'-0"

MODULE LEGEND

-  MODULE WITH DEFELECTOR
-  MODULE WITHOUT DEFELECTOR

BALLAST LEGEND

-  1-BLOCK (STANDARD)
-  2-BLOCK (STANDARD)
-  3-BLOCK (STANDARD)
-  2-BLOCK (SOUTH)

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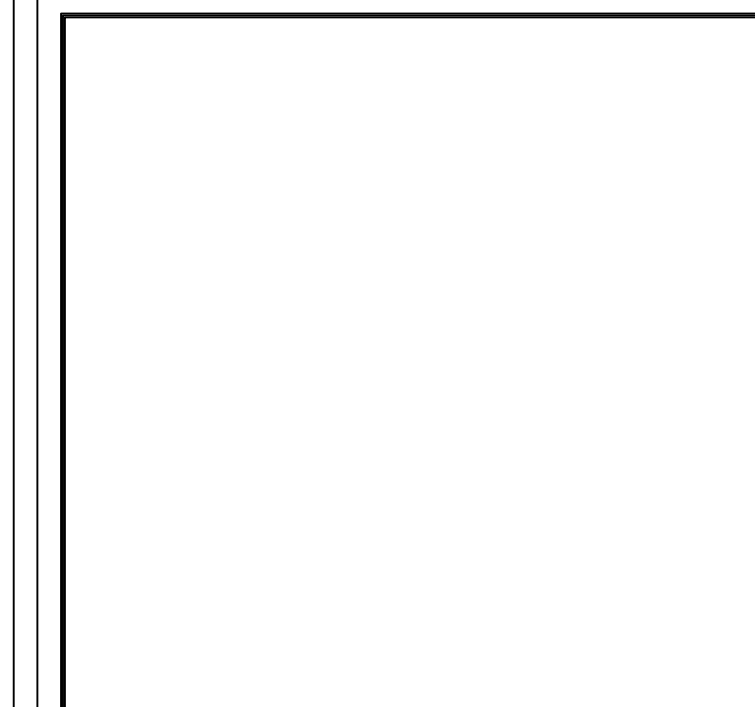
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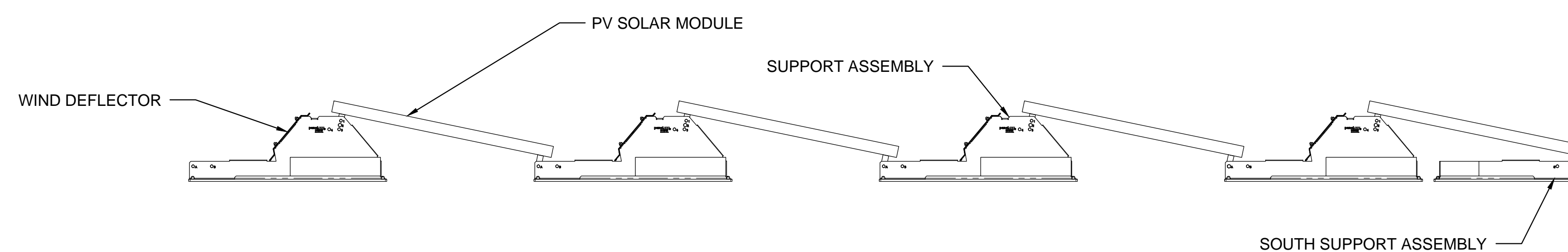
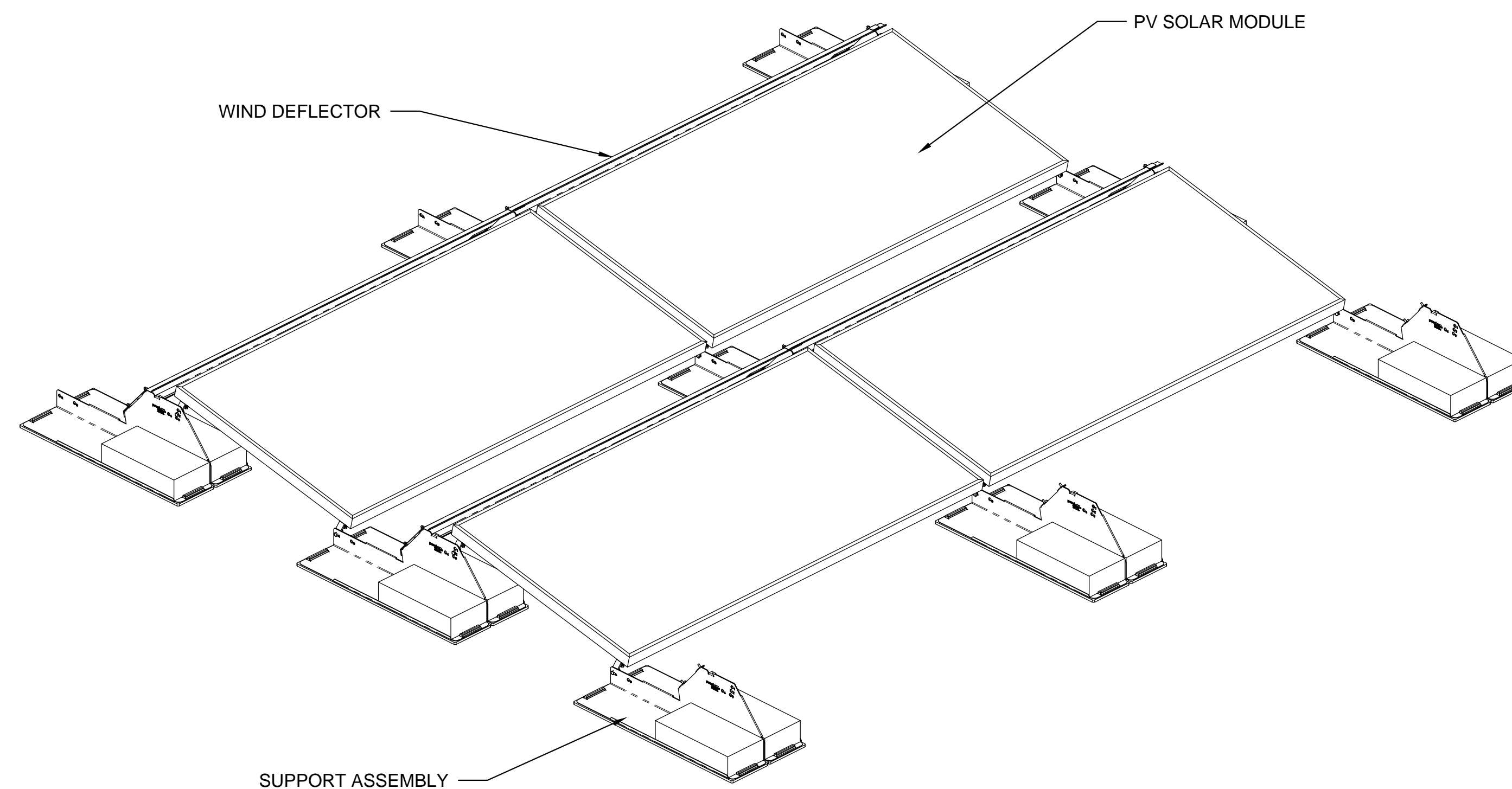
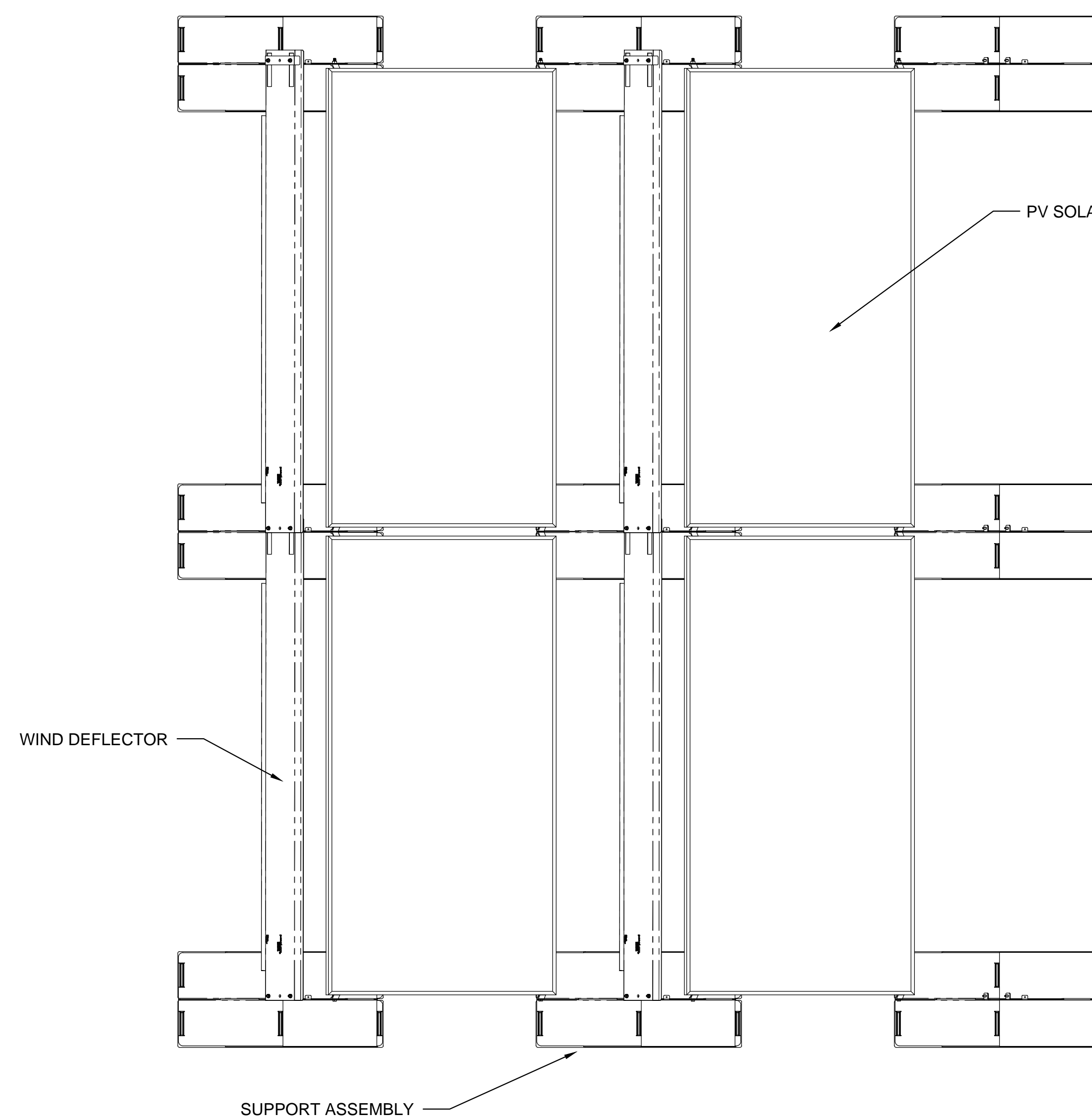


SHEET TITLE:

**RACKING
DETAILS**

SHEET NUMBER:

S2



1 RACKING DETAIL
SCALE: 3" = 1'-0"