

CONSTRUCT SOLAR ARRAY BUILDING 1030 FORT LEONARD WOOD, MO

INDEX OF DRAWINGS

G-001 COVER SHEET
E-001 ELECTRICAL LEGEND AND NOTES
E-101 ELECTRICAL PLAN SOLAR ARRAY
E-501 ELECTRICAL DETAILS
E-601 ELECTRICAL ONE LINE DIAGRAM



APPLICABLE CODES/DESIGN CONSIDERATIONS

INTERNATIONAL BUILDING CODE (IBC) 2021
THE AMERICAN WITH DISABILITIES ACT (ADAAG) 2010
INTERNATIONAL MECHANICAL CODE (IMC) 2021
INTERNATIONAL PLUMBING CODE (IPC) 2021
ASHRAE 90.1 - 2016 ENERGY STANDARD FOR BUILDINGS
NATIONAL ELECTRIC CODE (NEC) 2020

OWNER: STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

MISSOURI NATIONAL GUARD
OFFICE OF THE ADJUTANT GENERAL
FACILITIES MANAGEMENT OFFICE

PROJECT MANAGEMENT: OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT
DESIGN AND CONSTRUCTION

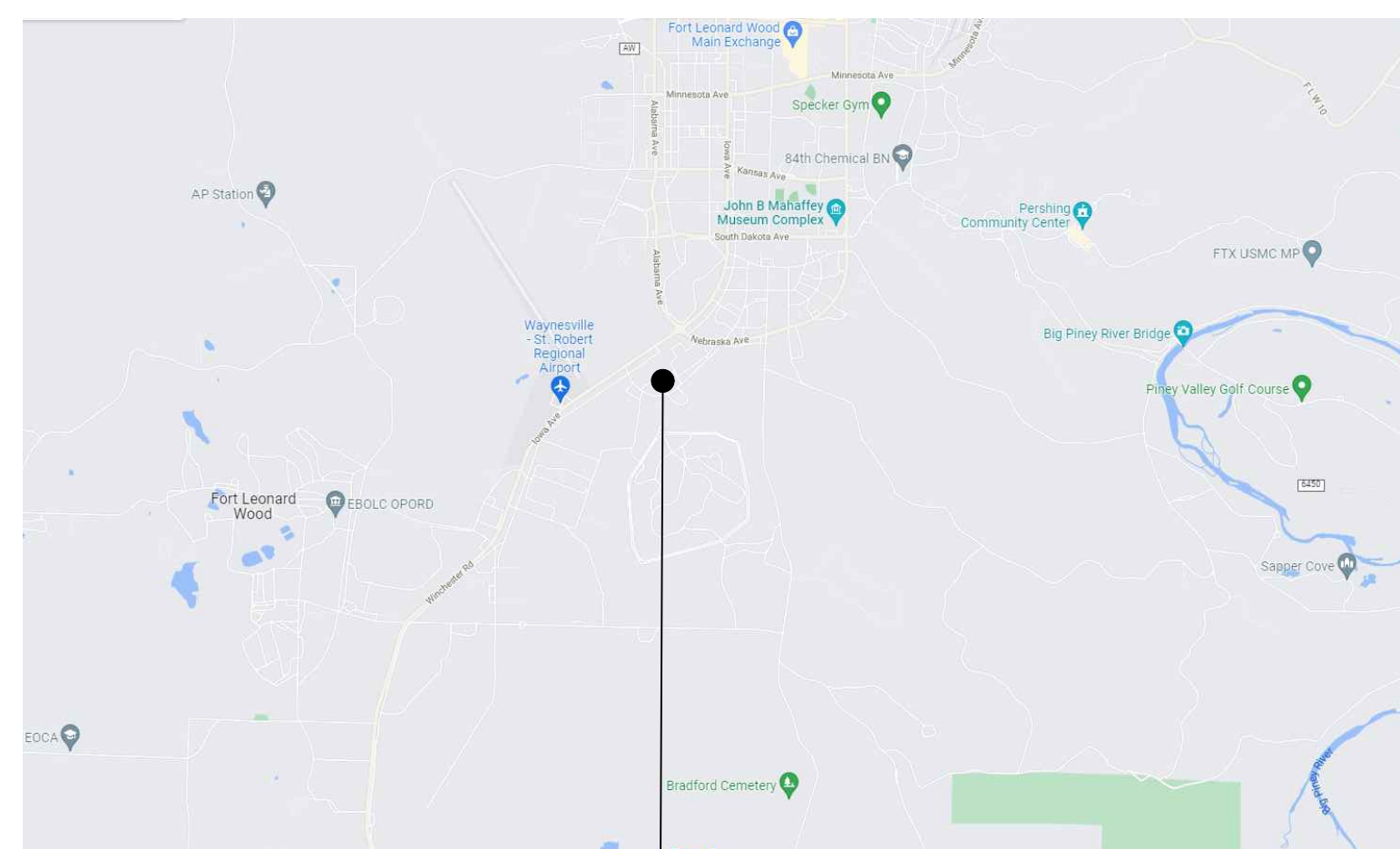
DESIGNER: CROSSED SWORDS ENGINEERING

PROJECT NUMBER: T2231-01

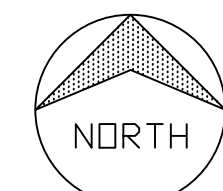
SITE NUMBER: 6306

ASSET NUMBER: 8136306003

SITE LOCATION MAP

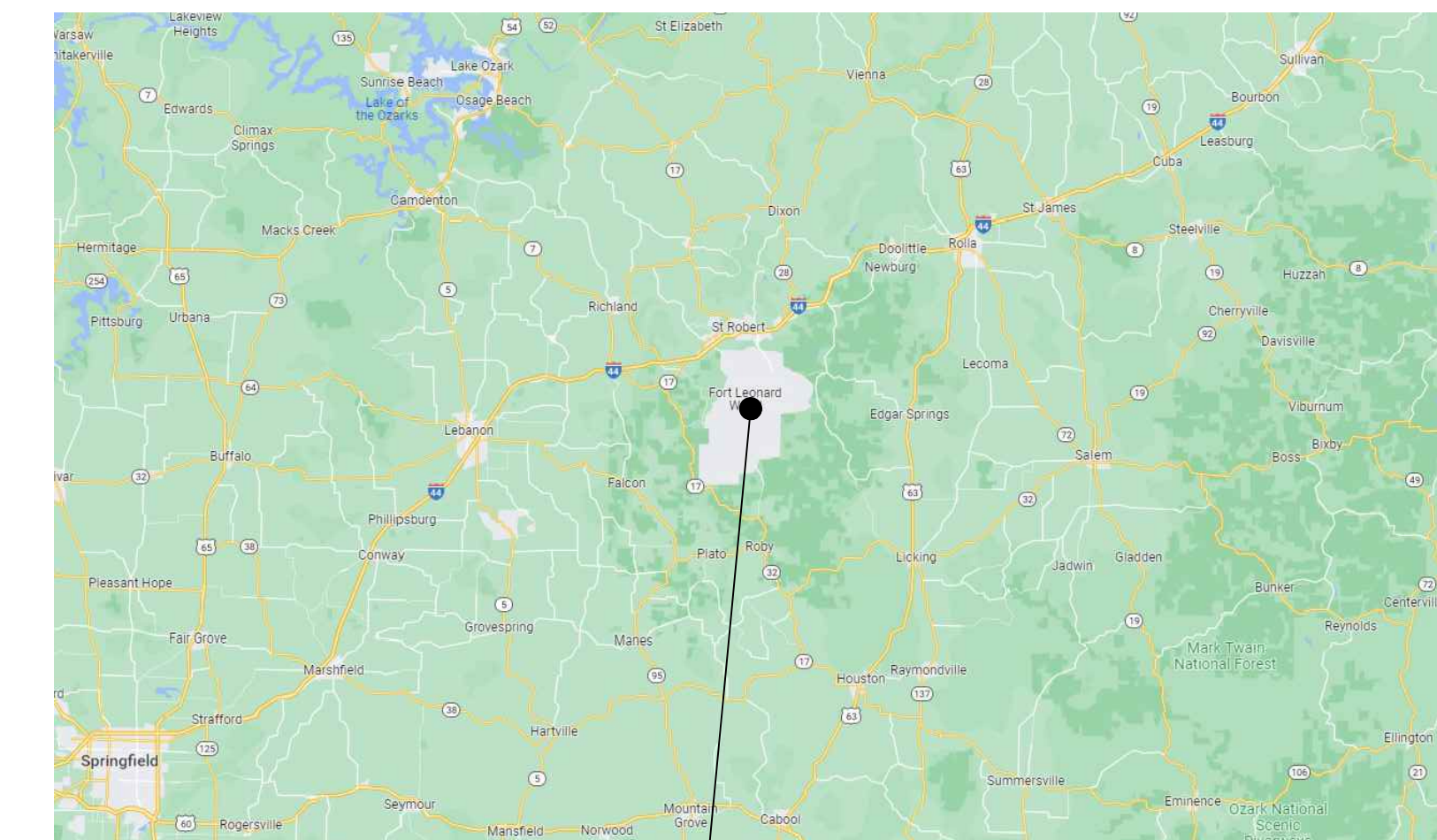


BUILDING 1030
FT LEONARD WOOD, MO
SITE: 5017



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1619 NE OAK TREE DRIVE
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MO CERTIFICATE OF AUTHORITY
#2016003099

REGIONAL LOCATION MAP



BUILDING 1030
FT LEONARD WOOD, MO
SITE: 5017



ISSUED FOR
CONSTRUCTION
2/13/2023

SHEET NUMBER:

G-001

1 OF 5 SHEETS
FEBRUARY 13, 2023

GENERAL ELECTRICAL NOTES

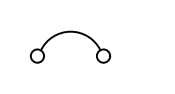
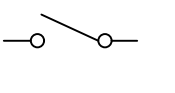
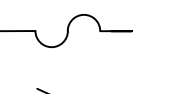
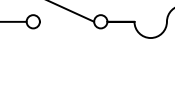

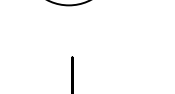
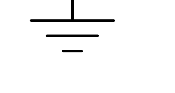
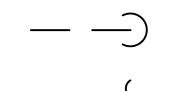

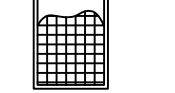

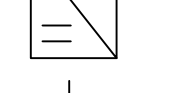
- PHOTOVOLTAIC (PV) SYSTEMS SHALL COMPLY WITH THE NATIONAL ELECTRIC CODE (NEC) ARTICLE 690.
- ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS'S LISTING AND INSTALLATION INSTRUCTIONS, AND THE RELEVANT CODES AS SPECIFIED BY THE AUTHORITY HAVING JURISDICTION'S (AHJ) APPLICABLE CODES.
- THE UTILITY INTERCONNECTION APPLICATION MUST BE APPROVED AND PV SYSTEM INSPECTED PRIOR TO PARALLEL OPERATION
- LOAD-SIDE INTERCONNECTION SHALL BE IN ACCORDANCE WITH [NEC 690.64 (B)]
- ALL PV SYSTEM COMPONENTS; MODULES, UTILITY-INTERACTIVE INVERTERS, AND SOURCE CIRCUIT COMBINER BOXES ARE IDENTIFIED AND LISTED FOR USE IN PHOTOVOLTAIC SYSTEMS AS REQUIRED BY [NEC 690.4] & [NEC 690.60]
- PV MODULES:UL 1703 CERTIFIED, NFPA 70 CLASS C FIRE INVERTER(S):UL 1741 CERTIFIED, IEEE 1547, 929, 519 COMBINER BOX(S):UL 1703 OR UL 1741 ACCESSORY
- PV STRING HOME RUNS MUST BE LABELED AT ALL TERMINATIONS. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, ACCESSORIES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATION AS INDICATED ON THE DRAWINGS
- SUPPORT CONDUCTORS IN VERTICAL CONDUIT IN ACCORDANCE WITH THE REQUIREMENTS OF NEC 300.19.

GROUNDING NOTES

- ONLY ONE CONNECTION TO AC CIRCUITS WILL BE USED FOR SYSTEM GROUNDING (NEC 690.42).
- RACKING AND STRUCTURAL COMPONENTS MUST BE ELECTRICALLY BONDED TOGETHER BY AN ACCEPTABLE MEANS. RACKING SYSTEM SHALL BE LISTED UL2703.
- MODULES SHALL BE GROUNDED WITH EQUIPMENT GROUNDING CONDUCTORS BONDED TO A LOCATION MEETING MANUFACTURER REQUIREMENTS WITH A MEANS OF BONDING LISTED FOR THIS PURPOSE.
- A GROUNDING ELECTRODE SYSTEM IN ACCORDANCE WITH NEC 690.47 AND NEC 250.50 THROUGH NEC 250.166 SHALL BE PROVIDED.
- PV SYSTEM SHALL BE GROUNDED IN ACCORDANCE WITH NEC 250.21 AND ALL METAL PARTS OR MODULE FRAMES ACCORDING TO NEC 690.43.
- ALL CONDUIT BETWEEN THE UTILITY AC DISCONNECT AND THE POINT OF CONNECTION IN THE MDP SHALL HAVE GROUNDED BUSHINGS AT BOTH ENDS.

SCHEDULE OF ALTERNATES

- BASE BID. PROVIDE AND INSTALL 60 KW OF THE 100 KW SOLAR ARRAY SYSTEM ON THE SOUTH ROOF AREA OF BUILDING 1030. PROVIDE ONLY THE STRUCTURAL FRAMING AND INVERTERS FOR THE 60 KW SYSTEM. THE COMBINER PANEL, CONDUIT, WIRING, AND SYSTEM DISCONNECT SHALL STILL BE SIZED FOR THE FULL 100 KW SYSTEM.
- ALTERNATE NO. 1: PROVIDE AND INSTALL THE ADDITIONAL 40 KW OF SOLAR ARRAYS TO THE ROOF FOR A FULL 100 KW OF SOLAR POWER.

ABBREVIATIONS	SYMBOLS LEGEND	SYSTEM NOTES	CONSTRUCTION GENERAL NOTES
<p>A AMPERE</p> <p>AC ALTERNATING CURRENT</p> <p>AFCI ARC-FAULT CIRCUIT INTERRUPTER</p> <p>AHJ AUTHORITY HAVING JURISDICTION</p> <p>AIC AMERAGE INTERRUPTION CAPACITY</p> <p>ATS AUTOMATIC TRANSFER SWITCH</p> <p>AWG AMERICAN WIRE GAUGE</p> <p>CB-# CIRCUIT BREAKER</p> <p>BLDG BUILDING</p> <p>DC DIRECT CURRENT</p> <p>DWG DRAWING</p> <p>EMT ELECTRICAL METALLIC TUBE</p> <p>GFCI GROUND FAULT CIRCUIT INTERRUPTER</p> <p>GFP GROUND FAULT PROTECTION</p> <p>GND GROUND</p> <p>GEC GROUNDING ELECTRODE CONDUCTOR</p> <p>IBC INTERNATIONAL BUILDING CODE</p> <p>IFC INTERNATIONAL FIRE CODE</p> <p>KW KILOWATT</p> <p>MCB MAIN CIRCUIT BREAKER</p> <p>MDP MAIN DISTRIBUTION PANEL</p> <p>MLO MAIN LUG ONLY</p> <p>MTS MANUAL TRANSFER SWITCH</p> <p>N NEUTRAL</p> <p>NEC NATIONAL ELECTRICAL CODE</p> <p>NTS NOT TO SCALE</p> <p>OC ON CENTER</p> <p>OCPD OVERCURRENT PROTECTION DEVICE</p> <p>P POLE</p> <p>PH PHASE</p> <p>POC POINT OF CONNECTION</p> <p>PV PHOTOVOLTAIC</p> <p>RMC RIGID METALLIC CONDUIT</p> <p>SC SOURCE CIRCUIT</p> <p>TYP TYPICAL</p> <p>UL UNDERWRITERS LABORATORY</p> <p>V VOLT OR VOLTAGE</p> <p>W WATT</p> <p>XFMR TRANSFORMER</p>	<p> ELECTRICAL BREAKER</p> <p> ELECTRICAL DISCONNECT SWITCH</p> <p> ELECTRICAL FUSE</p> <p> ELECTRICAL FUSED DISCONNECT SWITCH</p> <p> METER</p> <p> SYSTEM OR EQUIPMENT GROUND</p> <p> CONDUIT DOWN</p> <p> CONTINUATION OF CONDUIT</p> <p> PHOTOVOLTAIC (PV) MODULE</p> <p> DC/AC INVERTER</p> <p> POWER TRANSFORMER</p> <p> CONNECTED CONDUCTOR</p> <p>APPLICABLE CODES</p> <p>NATIONAL ELECTRIC CODE (NEC), 2020 INTERNATIONAL BUILDING CODE (IBC), 2021 INTERNATIONAL FIRE CODE (IFC), 2021 LACLEDE ELECTRIC COOP UTILITY REQUIREMENTS</p>	<p>1. SOLAR ARRAY CONSISTS OF PV MODULES, CONNECTED IN SERIES.</p> <p>2. ARRAYS HAVE BEEN PLACED TO MINIMIZE OR ELIMINATE SHADING IMPACT FROM ADJACENT STRUCTURES AND/OR OBSTRUCTIONS.</p> <p>3. INVERTERS SHALL BE TRANSFORMERLESS STRING INVERTERS, LOCATED PER PLAN.</p> <p>SITE INFORMATION</p> <p>UTILITY COMPANY: LACLEDE ELECTRIC COOP</p> <p>POINT OF CONTACT: TERRY ROSENTHAL LACLEDE ELECTRIC COOP TROSENTHAL@LACLEDEELECTIC.COM O: 417-532-3164</p>	<p>1. ALL ELECTRICAL WORK SHALL BE PERFORMED BY A QUALIFIED LICENSED ELECTRICIAN AND/OR APPRENTICES WORKING UNDER THE DIRECT SUPERVISION OF THE LICENSED CONTRACTOR.</p> <p>2. ALL WORK CARRIED OUT SHALL COMPLY WITH THE SPECIFICATIONS, APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES, AND APPLICABLE REGULATIONS.</p> <p>3. PRIOR TO COMMENCEMENT OF ANY WORK, THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES NOTED AMONG SITE CONDITIONS, MANUFACTURER RECOMMENDATIONS, OR AUTHORITY HAVING JURISDICTION. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER OF RECORD A WRITTEN "RFI"(REQUEST FOR INFORMATION) PROPOSING AN ALTERNATIVE OR SEEKING CLARIFICATION.</p> <p>4. THE CONTRACTOR SHALL MAINTAIN IN GOOD CONDITION ONE COMPLETE SET OF PLANS WITH ALL REVISIONS, ADDENDA, AND CHANGE ORDERS ON THE PREMISES AT ALL TIMES.</p> <p>5. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, ACCESSORIES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.</p> <p>6. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. CONTRACTOR SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS, AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF WORK.</p> <p>7. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.</p> <p>8. CONTRACTOR SHALL BE RESPONSIBLE FOR THE SAFETY OF WORK AREA, ADJACENT AREAS AND BUILDING OCCUPANTS THAT ARE LIKELY TO BE AFFECTED BY THE WORK UNDER THIS CONTRACT. WORK SHALL CONFORM TO ALL OSHA REQUIREMENTS AND THE LOCAL JURISDICTION.</p> <p>9. CONTRACTOR SHALL LEAVE PREMISES IN A CLEAN CONDITION. ALL DEBRIS AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN A LAWFUL MANNER PER SPECIFICATIONS.</p> <p>10. THE CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING AND STRUCTURES NOT PART OF THE SCOPE OF WORK AS IDENTIFIED IN THESE PLANS.</p> <p>11. DUE TO THE FACT THAT PV MODULES ARE ENERGIZED WHENEVER THEY ARE EXPOSED TO LIGHT, CONTRACTOR SHALL DISABLE THE ARRAY DURING INSTALLATION AND SERVICE BY SHORT CIRCUITING, OPEN CIRCUITING, OR COVERING ARRAY WITH AN OPAQUE COVER ACCORDING TO MANUFACTURER'S INSTRUCTION.</p> <p>MONITORING AND CONTROLS</p> <p>CONTRACTOR SHALL PROVIDE A WIRELESS MONITORING AND CONTROLS NETWORK. THE SOLAR INVERTERS SHALL BE PROVIDED WITH MANUFACTURER STANDARD WIRELESS ACCESS CAPABILITY. CONTRACTOR SHALL PROVIDE CELLULAR HOTSPOT THAT WILL UPLOAD AND ALLOW CONTROL FROM A PASSWORD PROTECTED WEB ACCESS SYSTEM. THE CONTRACTOR SHALL INSTALL THE WEB MONITORING SOFTWARE ON AN EXISTING COMPUTER AS DESIGNATED BY THE STATE PROJECT MANAGER. SEE SPECIFICATION 263100 FOR ADDITIONAL INFORMATION.</p>



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CONSTRUCT SOLAR ARRAY

REGIONAL TRAINING
INSTITUTE
BUILDING 1030
FT. LEONARD WOOD, MO 65473

PROJECT # T2231-01
SITE # 6306
ASSET # 8136306003

REVISION: _____
DATE: _____
REVISION: _____
DATE: _____
REVISION: _____
DATE: _____
ISSUE DATE: 2/13/2023

CAD DWG FILE: E-001.DWG
DRAWN BY: RFS
CHECKED BY: JC
DESIGNED BY: RFS

SHEET TITLE:
**ELECTRICAL
LEGEND AND NOTES**

SHEET NUMBER:

E-001

GENERAL NOTES

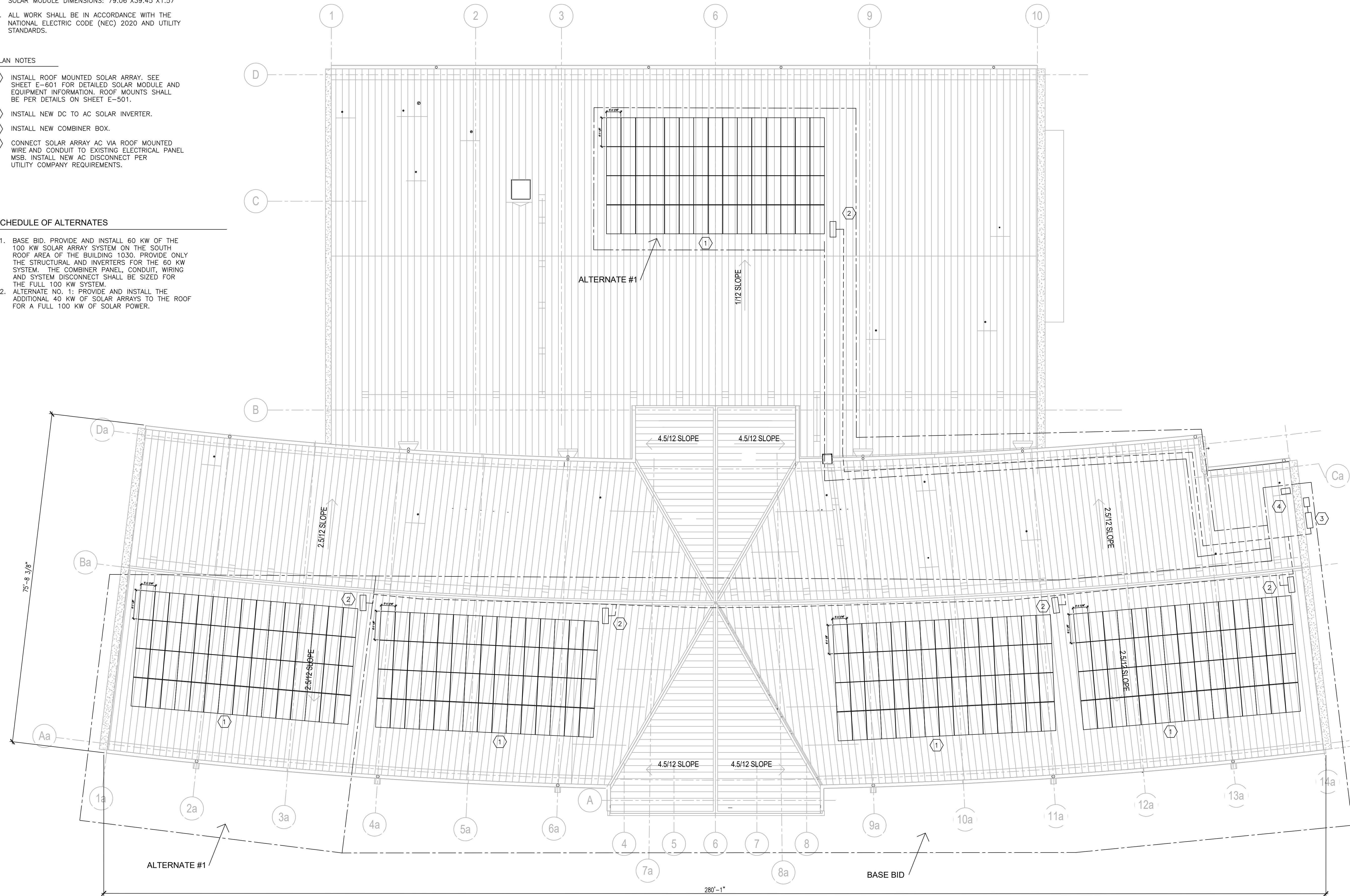
1. SEE GENERAL NOTES SHEET E-001 FOR ADDITIONAL INFORMATION
2. ALL CONDUIT RUNS ABOVE GRADE.
3. SYSTEM INFORMATION. (FOR REFERENCE ONLY)
SOLAR MODULE WEIGHT: 49.6 LBS.
SOLAR MODULE DIMENSIONS: 79.06"X39.45"X1.57"
4. ALL WORK SHALL BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC) 2020 AND UTILITY STANDARDS.

PLAN NOTES

- ① INSTALL ROOF MOUNTED SOLAR ARRAY. SEE SHEET E-601 FOR DETAILED SOLAR MODULE AND EQUIPMENT INFORMATION. ROOF MOUNTS SHALL BE PER DETAILS ON SHEET E-501.
- ② INSTALL NEW DC TO AC SOLAR INVERTER.
- ③ INSTALL NEW COMBINER BOX.
- ④ CONNECT SOLAR ARRAY AC VIA ROOF MOUNTED WIRE AND CONDUIT TO EXISTING ELECTRICAL PANEL MSB. INSTALL NEW AC DISCONNECT PER UTILITY COMPANY REQUIREMENTS.

SCHEDULE OF ALTERNATES

1. BASE BID. PROVIDE AND INSTALL 60 KW OF THE 100 KW SOLAR ARRAY SYSTEM ON THE SOUTH ROOF AREA OF THE BUILDING 1030. PROVIDE ONLY THE STRUCTURAL AND INVERTERS FOR THE 60 KW SYSTEM. THE COMBINER PANEL, CONDUIT, WIRING AND SYSTEM DISCONNECT SHALL BE SIZED FOR THE FULL 100 KW SYSTEM.
2. ALTERNATE NO. 1: PROVIDE AND INSTALL THE ADDITIONAL 40 KW OF SOLAR ARRAYS TO THE ROOF FOR A FULL 100 KW OF SOLAR POWER.



1	ROOF PLAN	
3/32"=1'-0"	-	

STATE OF MISSOURI
MICHAEL L. PARSON,
GOVERNOR



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CONSTRUCT SOLAR ARRAY

REGIONAL TRAINING
INSTITUTE
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FT. LEONARD WOOD, MO 65473

PROJECT # T2231-01
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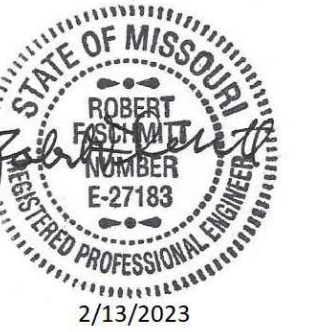
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DRAWN BY: RFS
CHECKED BY: JC
DESIGNED BY: RFS

SHEET TITLE:
**ELECTRICAL PLAN
SOLAR ARRAY**

SHEET NUMBER:

E-101

3 OF 5 SHEETS
FEBRUARY 13, 2023



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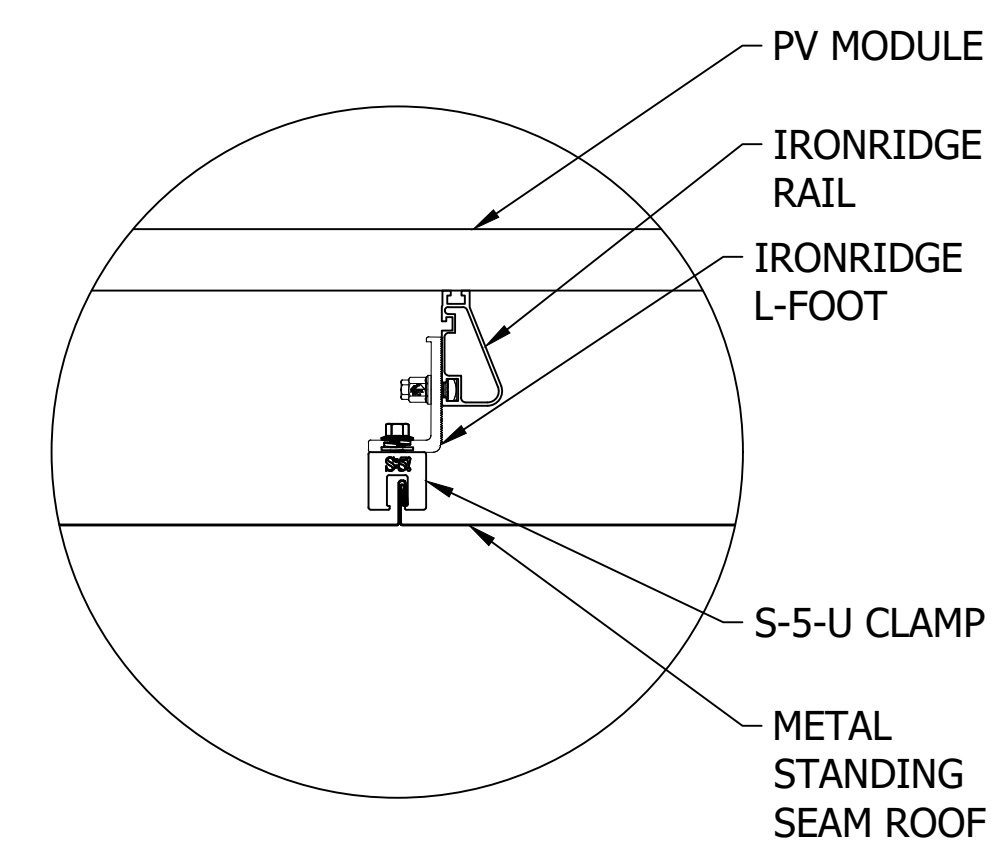
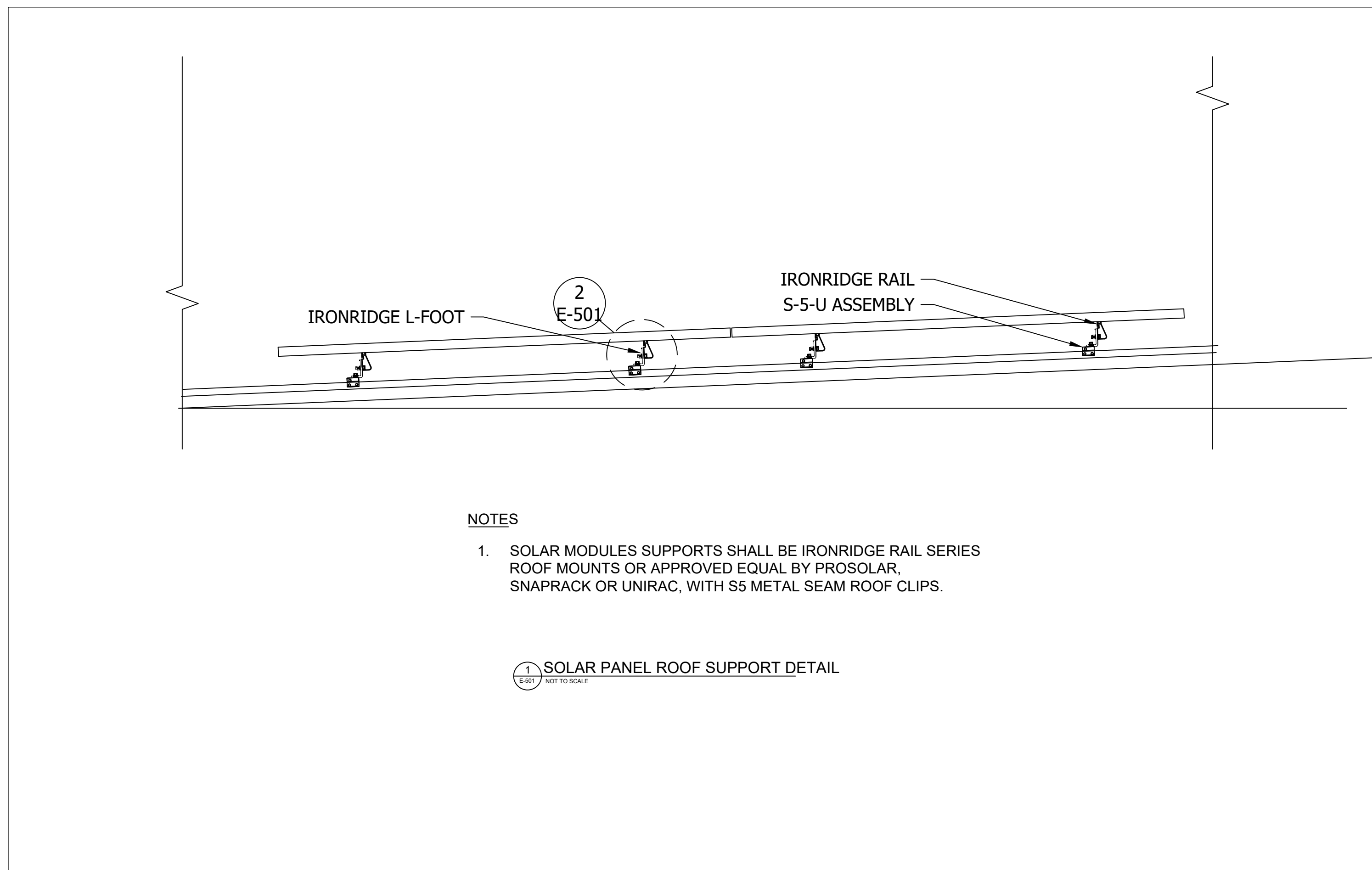
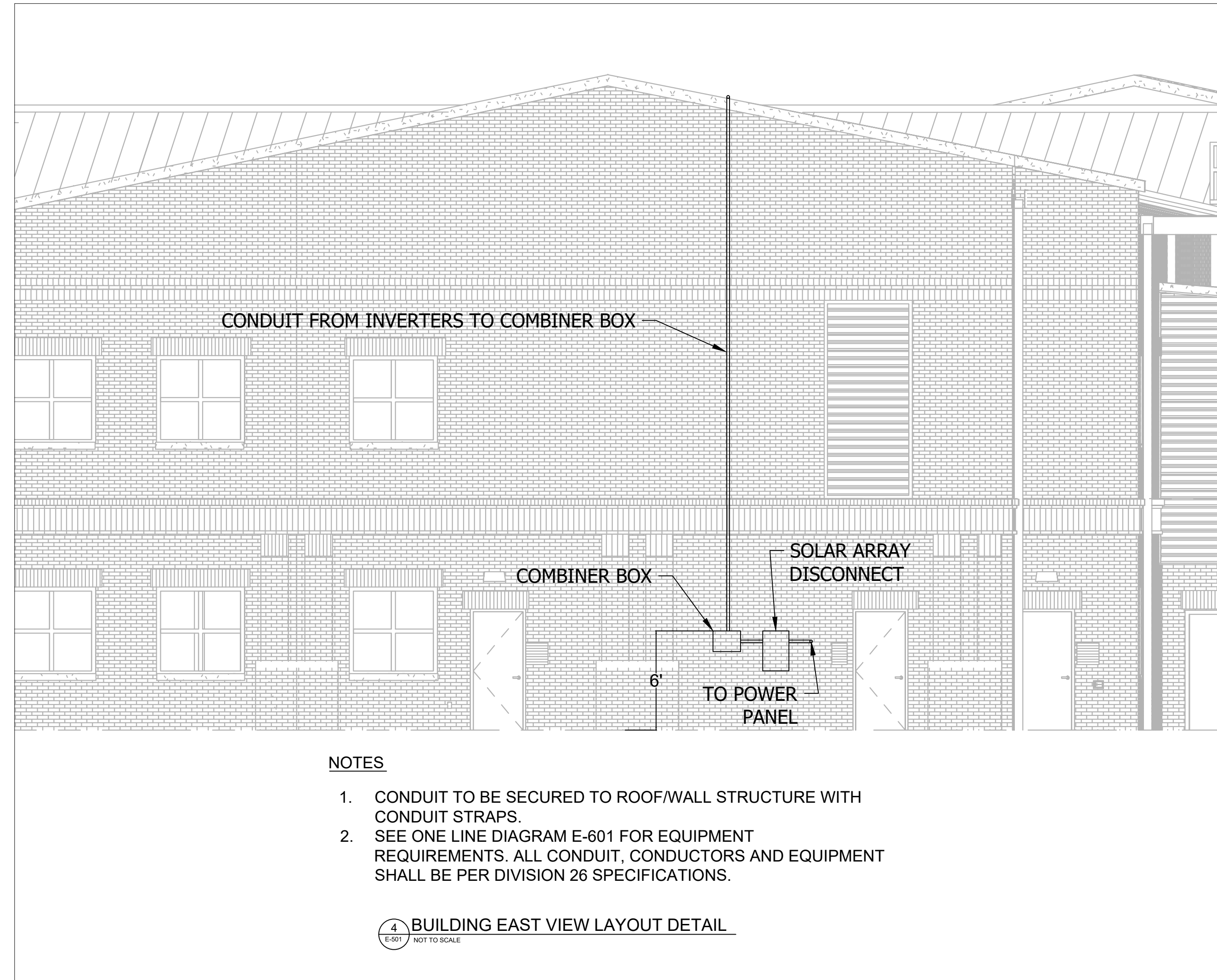
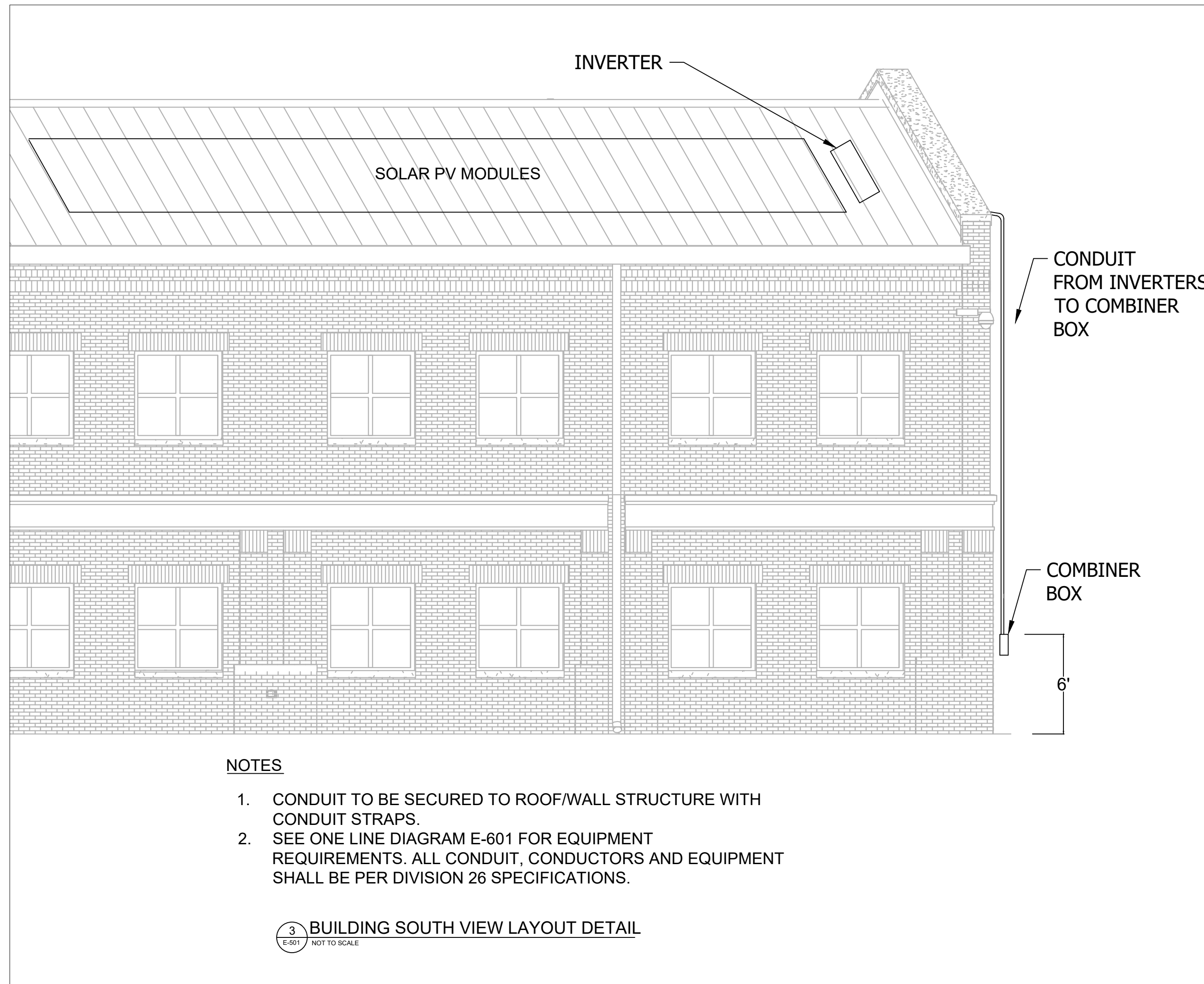
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CAD DWG FILE: E-501.DWG
DRAWN BY: RFS
CHECKED BY: RFS
DESIGNED BY: RFS

SHEET TITLE:
**ELECTRICAL
DETAILS**

SHEET NUMBER:

E-501





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CAD DWG FILE: E-601.DWG
DRAWN BY: RFS
CHECKED BY: JC
DESIGNED BY: RFS

SHEET TITLE:
**ELECTRICAL
ONE LINE DIAGRAM**

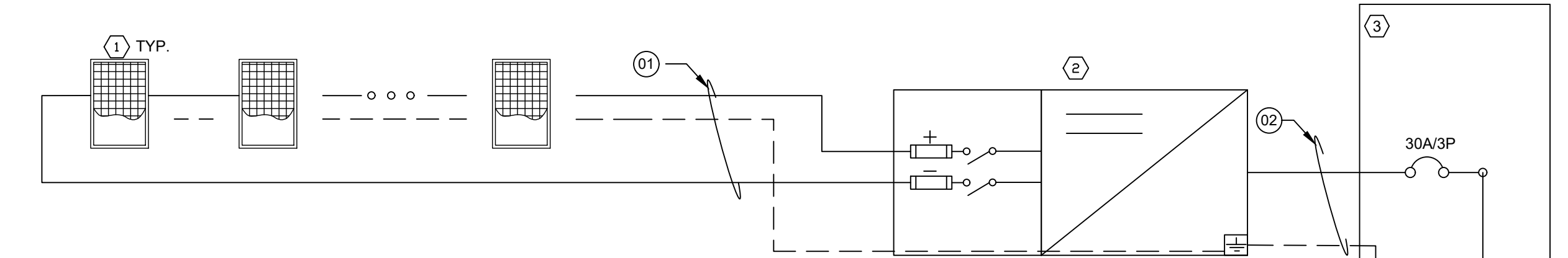
SHEET NUMBER:
E-601

**BUILDING 1030 - 100 KW AC OUTPUT SOLAR ARRAY
DC TO AC RATIO 1.2**

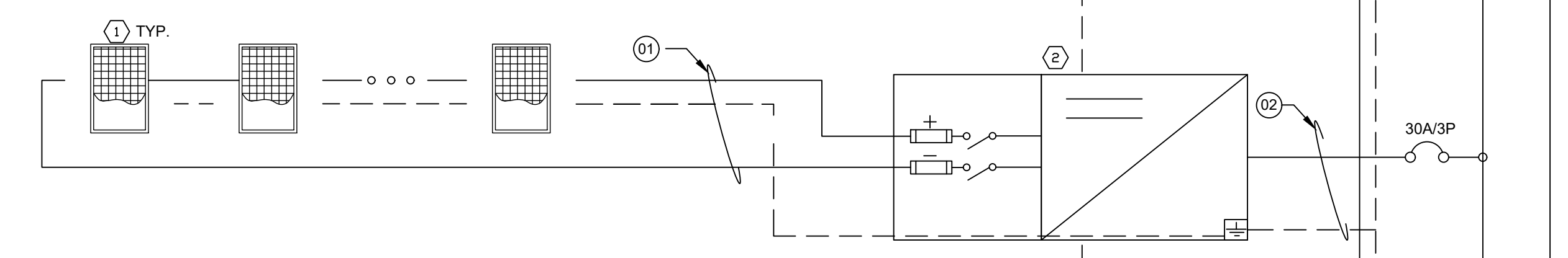
SHEET NOTES

- SOLAR MODULES INCLUDE OUTDOOR RATED QUICK CONNECTS WITH MULTI CONTACT CONNECTORS FOR MODULE INTERCONNECTION. DO NOT REMOVE THE QUICK CONNECTS, OTHERWISE THE MODULE WARRANTY AND THE UL LISTING MAY BE INVALIDATED.
- PV MODULES STRUNG IN SERIES. MODULE AND RACKING GROUNDING ACCOMPLISHED VIA CONTINUOUS CU CONDUCTOR.
- MODIFY EXISTING ELECTRICAL PANEL AS REQUIRED FOR THE CONNECTION OF INVERTER OUTPUT POWER TO THE PANEL.

INVERTER #1 (BASE BID)
MPPT1: 2 STRINGS OF 15 MODULES IN SERIES
MPPT2: 2 STRINGS OF 15 MODULES IN SERIES



INVERTER #2 - 5 (INVERTERS 2,3 BASE BID, INVERTERS 4,5 ALTERNATE #1)
MPPT1: 2 STRINGS OF 15 MODULES IN SERIES
MPPT2: 2 STRINGS OF 15 MODULES IN SERIES



TO CONTROLS MONITORING SYSTEM

SCHEDULE OF ALTERNATES

- BASE BID. PROVIDE AND INSTALL 60 KW OF THE 100 KW SOLAR ARRAY SYSTEM ON THE SOUTH ROOF AREA OF BUILDING 1030. PROVIDE ONLY THE STRUCTURAL FRAMING AND INVERTERS FOR THE 60 KW SYSTEM. THE COMBINER PANEL, CONDUIT, WIRING, AND SYSTEM DISCONNECT SHALL STILL BE SIZED FOR THE FULL 100 KW SYSTEM.
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ID	QTY	DESCRIPTION
1	300	JINKO JMK400M-72HL-V, SOLAR MODULE. QTY 200 BASE BID. QTY 100 ALTERNATE #1.
2	5	20.0 KW STRING INVERTER, 2 MPPT WITH 6 INPUT PAIRS PER MPPT, 480V, 3 PHASE, 60 HZ, FRONIUS SYMO MODEL 20-0-3-480. QTY 3 BASE BID. QTY 2 ALTERNATE #1.
3	1	AC COMBINING PANEL, 250A, 3P, 4 W, WITH (5) 30 A CIRCUIT BREAKERS, NEMA 3R
4	1	PV AC SOLAR SYSTEM DISCONNECT, FUSED 200A, 3 PHASE, NEMA 3R SQUARE D OR APPROVED EQUAL
5	1	EXISTING MAIN PANEL LCS, 480V, 3PH, WYE.
6	1	EXISTING METER LOCATED AT BUILDING 1030 TRANSFORMER

ID	CONDUCTOR	EGC	CONDUIT	CONDUCTORS IN CONDUIT	TEMPERATURE RATING
01	10 AWG PV WIRE	10 AWG	--	--	75C
02	8 AWG THWN-2	10 AWG	3/4"	4	75C
03	1 AWG	6 AWG	1 1/4"	4	75C
04	1 AWG	6 AWG	1 1/4"	4	75C

- ALL EXPOSED SOURCE CIRCUIT CONDUCTORS SHALL BE 600V RATED PV-WIRE SUITABLE FOR USE WITH TRANSFORMERLESS INVERTERS.
- ALL CONDUIT TO BE PER SPECIFICATIONS UNLESS OTHERWISE REQUIRED BY LOCAL AHJ.
- ALL CONDUIT SIZES ARE BASED ON MINIMUM PER NEC CODE REQUIREMENTS.
- WIRE AMPACITY IS BASED ON NUMBER OF WIRES PER CONDUIT. IF CONDUITS ARE INSTALLED DIFFERENTLY THAN SHOWN, WIRE SIZES MAY BE AFFECTED.

SITE CONDITIONS:	
ASHRAE MAX AVG. TEMP:	98.3°F
ASHRAE EXTREME MIN TEMP:	-0.4°F
PV MODULE OUTPUT	
VOC:	49.1 Vdc
TEMP. COEFFICIENT OF Voc:	-0.29 %/°C
ISC:	10.61 Adc
VMP:	40.16 Vdc
IMP:	9.96 Adc
INVERTER DETAILS	
RATED POWER OUTPUT (kW)	20.0
OUTPUT VOLTAGE (V)	480
OUTPUT CURRENT (A)	24
SOURCE CIRCUIT DETAILS	
MODULES PER STRING	15
TEMPERATURE ADJUSTED VOC	824.9
SHORT CIRCUIT CURRENT	49.1

