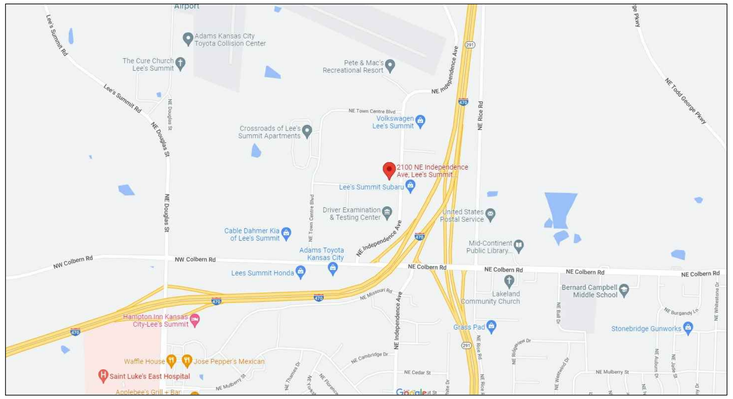
94.05 KW DC ROOFTOP PHOTOVOLTAIC SYSTEM
2100 NE INDEPENDENCE AVE, LEE'S SUMMIT, MO 64064, USA



1 VICINITY MAP

Scale: NTS

2 AERIAL VIEW

Scale: NTS

PROJECT INFORMATION

SCOPE OF WORK:

THE PROJECT IS TO INSTALL A ROOF MOUNT PHOTOVOLTAIC SYSTEM AND ALL ASSOCIATED POWER EQUIPMENT AT A COMMERCIAL PROPERTY.SYSTEM WILL BE INTERCONNECTED TO THE ELECTRICAL UTILITY GRID PER THE REQUIREMENTS OF THE UTILITY COMPANY AND ALL APPLICABLE LOCAL AND NATIONAL CODES.

SYSTEM SPECIFICATIONS

MODULE -	ZNSHINESOLAR
TOTAL MODULE COUNT	209
NOMINAL POWER	450W
TOTAL DC SYSTEM RATING	94.05 kW DC
INVERTER -	FRONIUS (SYMO 24.0-3 480)
TOTAL INVERTER COUNT	2
TOTAL INVERTER OUTPUT	48 KW AC
INVERTER -	FRONIUS (SYMO 20.0-3 480)
TOTAL INVERTER COUNT	1
TOTAL INVERTER OUTPUT	20 KW AC

DESIGN CRITERIA

DC DESIGN WILL BE BASED ON A 1000V DC.
ASHRAE DATA AVAILABLE FOR LEE'S SUMMIT MUNICIPAL IS AS FOLLOWS:

2% AVERAGE HIGHEST TEMP	38°C
EXTREME MINIMUM	-17.7°C

BUILDING NOTES

NO. OF STORIES	1
BUILDING HEIGHT	30'

NOTES

MODULE TILT	10°
MOUNTING TYPE	ROOFTOP
SOLAR ARRAY FOOTPRINT	4298.4 SQ. FT

LIST OF DRAWINGS / DOCUMENTS

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CALCULATIONS

GENERAL NOTES

THE DRAWINGS, SPECIFICATIONS AND ELECTRICAL DIAGRAMS CONTAINED HEREIN HAVE BEEN PREPARED BY DESIGN PROFESSIONALS WHO ARE LICENSED AND/OR AUTHORIZED TO PREPARE SUCH DRAWINGS IN THE STATE OF MISSOURI, AND HAVE BEEN EXAMINED FOR:

- DESIGN INTENT
- APPLICABLE CODES, REGULATIONS, AND STANDARDS
- COORDINATION OF THE WORK SHOWN ON RELATED PLANS

THE WORK IS DETERMINED TO BE ACCEPTABLE FOR INCORPORATION INTO THE CONSTRUCTION OF THIS PROJECT.

STATE OF MISSOURI
GERALD H. CRAFTON
NUMBER PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop
COVER SHEET
94.05 KW DC Rooftop Photovoltaic System
2100 NE Independence Ave, Lee's Summit, MO 64064, USA

Rev #	DATE	REMARKS
1	05-27-2022	Lee's Summit Detail Shop - Rev 1

DESIGNED | CHECKED | APPROVED

Artisun Solar
12916 5TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

DWG NO: T-1

PROJ NO: NEI-210

ABBREVIATIONS

A	AMPERE
AC	ALTERNATING CURRENT
AFCI	ARC-FAULT CIRCUIT INTERRUPTER
AHJ	AUTHORITY HAVING JURISDICTION
AIC	AMERAGE INTERRUPTION CAPACITY
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
CB-#	COMBINER BOX
DAS	DATA AQUISITION SYSTEM
DC	DIRECT CURRENT
DWG	DRAWING
EMT	ELECTRICAL METALLIC TUBE
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFP	GROUND FAULT PROTECTION
GND	GROUND
GEC	GROUNDING ELECTRODE CONDUCTOR
IBC	INTERNATIONAL BUILDING CODE
IFC	INTERNATIONAL FIRE CODE
KW	KILOWATT
MCB	MAIN CIRCUIT BREAKER
MDP	MAIN DISTRIBUTION PANEL
MLO	MAIN LUG ONLY
MTS	MANUAL TRANSFER SWITCH
N	NEUTRAL
NEC	NATIONAL ELECTRICAL CODE
NTS	NOT TO SCALE
OC	ON CENTER
OCPD	OVERCURRENT PROTECTION DEVICE
P	POLE
PH	PHASE
POC	POINT OF CONNECTION
PV	PHOTOVOLTAIC
RMC	RIGID METALLIC CONDUIT
SC	SOURCE CIRCUIT
TYP	TYPICAL
UL	UNDERWRITERS LABORATORY
V	VOLT OR VOLTAGE
W	WATT
XFMR	TRANSFORMER

SYMBOLS LEGEND

- ELECTRICAL BREAKER
- ELECTRICAL DISCONNECT SWITCH
- ELECTRICAL FUSE
- ELECTRICAL FUSED DISCONNECT SWITCH
- M — METER
- SYSTEM OR EQUIPMENT GROUND
- CONDUIT DOWN
- CONTINUATION OF CONDUIT
- PHOTOVOLTAIC (PV) MODULE
- DC/AC INVERTER
- POWER TRANSFORMER
- CONNECTED CONDUCTOR

APPLICABLE CODES

NATIONAL ELECTRIC CODE (NEC), 2017
INTERNATIONAL BUILDING CODE (IBC), 2018
INTERNATIONAL MECHANICAL CODE, 2018
INTERNATIONAL PLUMBING CODE, 2018
INTERNATIONAL FUEL GAS CODE, 2018
INTERNATIONAL FIRE CODE (IFC), 2018
ICC/ANSI A117.1-2009 AS AMENDED AND ADOPTED BY THE CITY OF LEE'S SUMMIT

CONSTRUCTION TYPE: TYPE 2
OCCUPANCY TYPE: B

*INCLUDES ALL LOCAL AND STATE AMENDMENTS

SYSTEM NOTES

1. SOLAR ARRAY CONSISTS OF PV MODULES, CONNECTED IN SERIES.
2. ARRAYS HAVE BEEN PLACED TO MINIMIZE OR ELIMINATE SHADING IMPACT FROM ADJACENT STRUCTURES AND/OR OBSTRUCTIONS.
3. ALL ARRAY LAYOUTS ADHERE TO LOCAL AHJ REQUIREMENTS FOR SETBACKS AND PATHWAYS.
4. MINIMUM 3 FOOT CLEARANCE PROVIDED FOR ALL ROOF TOP HVAC UNITS AND SERVICEABLE EQUIPMENT. MINIMUM 4 FOOT SETBACK TO ROOF EDGE.
5. INVERTERS SHALL BE TRANSFORMERLESS STRING INVERTERS, LOCATION PER PLAN.

SITE INFORMATION

UTILITY COMPANY: Evergy
METER NUMBERS: 23396913

GENERAL NOTES

1. ALL ELECTRICAL WORK SHALL BE PERFORMED BY A QUALIFIED LICENSED ELECTRICIAN AND/OR APPRENTICES WORKING UNDER THE DIRECT SUPERVISION OF THE LICENSED CONTRACTOR.
2. ALL WORK CARRIED OUT SHALL COMPLY WITH THE SPECIFICATIONS, APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES, AND APPLICABLE REGULATIONS.
3. PRIOR TO COMMENCEMENT OF ANY WORK, THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF AN 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.
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.
5. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, ACCESSORIES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
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.
7. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
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.
9. FALL ARREST PROTECTION PER OSHA REQUIREMENTS SHALL BE PROVIDED FOR ALL ROOF WORK.
10. WHEN INSTALLING IN FIRE RATED AREAS, SEAL ALL PENETRATIONS WITH UL LISTED MATERIALS APPROVED BY LOCAL JURISDICTION. CONTRACTOR SHALL KEEP AREA CLEAN, HAZARD FREE, AND DISPOSE OF ALL DEBRIS.
11. 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.
12. THE CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING AND STRUCTURES NOT PART OF THE SCOPE OF WORK AS IDENTIFIED IN THESE PLANS.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SECURITY OF THE SITE FOR THE DURATION OF CONSTRUCTION UNTIL JOB COMPLETION.
14. 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.
15. CONSTRUCTION LOADING ON THE ROOF, SUCH AS MATERIAL STAGED ON THE ROOF, SHALL BE LIMITED TO 20 PSF. CONCENTRATED LOADING SHALL BE AVOIDED TO PREVENT LOCALIZED DAMAGE TO THE ROOF.

ELECTRICAL NOTES

1. THE PV ELECTRIC SYSTEM IS INTENDED TO BE OPERATED IN PARALLEL WITH THE UTILITY ELECTRICAL SERVICE AND WILL BE CONNECTED TO THE EXISTING FACILITY POWER SYSTEM AT A SINGLE POC. THIS CONNECTION SHALL BE IN COMPLIANCE WITH NEC 705.12.
2. ALL INVERTERS AND PANELBOARDS SHALL BE SECURED FROM UNAUTHORIZED ACCESS BY LOCK OR LOCATION.
3. CONDUITS AND CABLES SHALL BE BOTTOM ENTRY ONLY TO ANY ENCLOSURE.
4. FEEDERS SHALL MAINTAIN PHASE RELATIONSHIP THROUGHOUT THE SYSTEM. PHASES SHALL MATCH BUS OR CABLE ARRANGEMENTS IN EQUIPMENT TO WHICH THE FEEDERS ARE CONNECTED. COLOR CODING SHALL BE AS FOLLOWS:

	208/120 VAC	480/277 VAC			1000VDC
PHASE A	BLACK	BROWN		POSITIVE	RED
PHASE B	RED	ORANGE		NEGATIVE	BLACK
PHASE C	BLUE	YELLOW		GROUNDED CONDUCTOR	WHITE
GROUNDED CONDUCTOR	WHITE	WHITE		GROUND	GREEN
GROUND	GREEN	GREEN			

5. 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 INSTALLATIONS AS INDICATED ON THE DRAWINGS.
6. SUPPORT CONDUCTORS IN VERTICAL CONDUIT IN ACCORDANCE WITH THE REQUIREMENTS OF NEC 300.19.

GROUNDING NOTES

1. ONLY ONE CONNECTION TO AC CIRCUITS WILL BE USED FOR SYSTEM GROUNDING (NEC 690.42).
2. RACKING AND STRUCTURAL COMPONENTS MUST BE ELECTRICALLY BONDED TOGETHER BY AN ACCEPTABLE MEANS. RACKING SYSTEM SHALL BE LISTED TO UL2703.
3. MODULES SHALL BE GROUNDED WITH EQUIPMENT GROUNDING CONDUCTORS BONDED TO A LOCATION APPROVED BY THE MANUFACTURER WITH A MEANS OF BONDING LISTED FOR THIS PURPOSE.
4. A GROUNDING ELECTRODE SYSTEM IN ACCORDANCE WITH NEC 690.47 AND NEC 250.50 THROUGH NEC 250.166 SHALL BE PROVIDED. THE GROUNDING ELECTRODE SYSTEM OF THE BUILDING MAY BE USED AND BONDED TO AT THE SERVICE ENTRANCE.
5. PV SYSTEM SHALL BE GROUNDED IN ACCORDANCE WITH NEC 250.21 AND ALL METAL PARTS OR MODULE FRAMES ACCORDING TO NEC 690.43.
6. ALL CONDUIT BETWEEN THE UTILITY AC DISCONNECT AND THE POC SHALL HAVE GROUNDED BUSHINGS AT BOTH ENDS OR OTHER METHODS AS APPROVED IN NEC 250.92.

STATE OF MISSOURI
GERALD H. SHARLTON
NUMBER PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop
LEGENDS & GEN. NOTES
94.05 KW DC Rooftop Photovoltaic System
2100 NE Independence Ave, Lee's Summit, MO 64064, USA

NAME OF CUSTOMER: | TITLE: | SUBJECT: | PROJECT LOCATION:

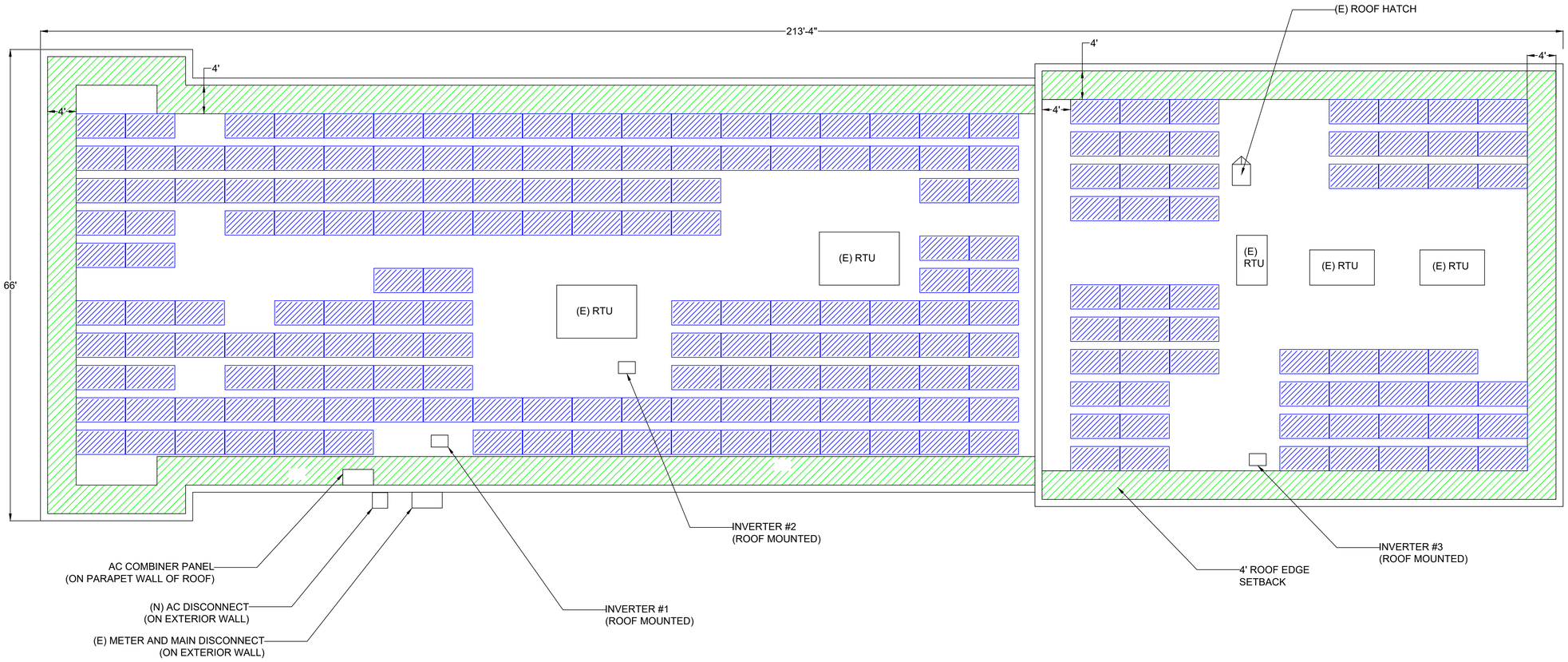
Rev.#	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

Artisun Solar
12916 5TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

DWG NO: G-1
PROJ NO: NEI-210

MODULE MAKE	ZNSHINESOLAR
MODULE TYPE	ZXM6-NHLDD144-450/M
MODULE DIMENSIONS	82.44" X 40.86" X 1.18"

MODULE COUNT PER ARRAY					
ARRAY	MODULE RATING (W)	AZIMUTH	TILT	MODULES	KWDC
ARRAY 1	450	180	10	209	94.05
			TOTAL	209	94.05



① ARRAY LAYOUT

Scale: 1/16"=1'

STATE OF MISSOURI
GERALD H. CRAFTON
NUMBER
PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop

SITE PLAN

94.05 KW DC Rooftop Photovoltaic System

2100 NE Independence Ave, Lee's Summit, MO 64064, USA

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TITLE:		SUBJECT:	PROJECT LOCATION:

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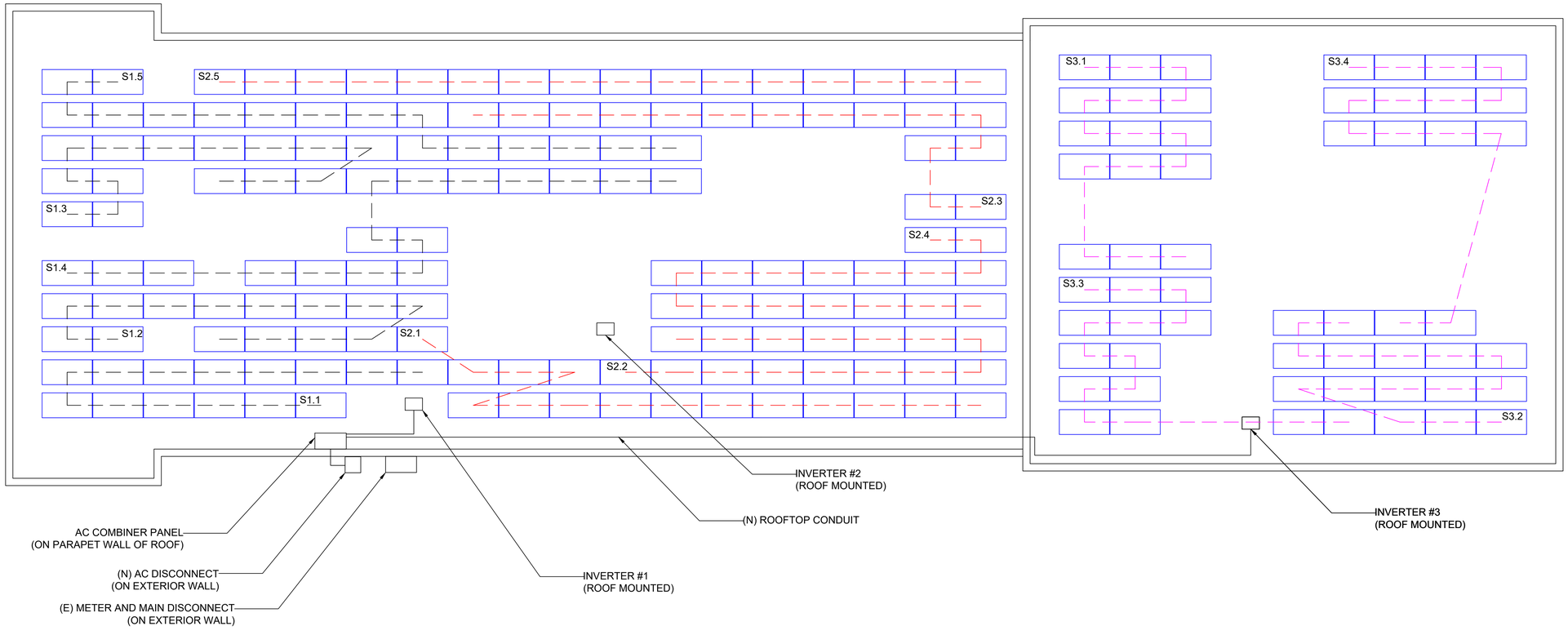
PH: (913) 601-0700

DWG NO: E-1

PROJ NO: NEI-210

STRING CONFIGURATION									
Array	Inverter No.	Inverter Capacity (KW)	MPPT No.	String Size	No. of Strings	Total Modules	Module Wattage (W)	Total DC Capacity (KW)	Module Count Per Inverter
ROOFTOP	1	24	1	14	3	42	450	18.9	74
			2	16	2	32	450	14.4	
	2	24	1	15	3	45	450	20.25	77
			2	16	2	32	450	14.4	
	3	20	1	15	2	30	450	13.5	58
			2	14	2	28	450	12.6	
TOTAL		**68**			**14**	**209**		**94.05**	



1 STRING DIAGRAM

Scale: 1/8"=1'

STATE OF MISSOURI
GERALD H. SHARLTON
NUMBER PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop

STRING DIAGRAM

94.05 KW DC Rooftop Photovoltaic System

2100 NE Independence Ave, Lee's Summit, MO 64064, USA

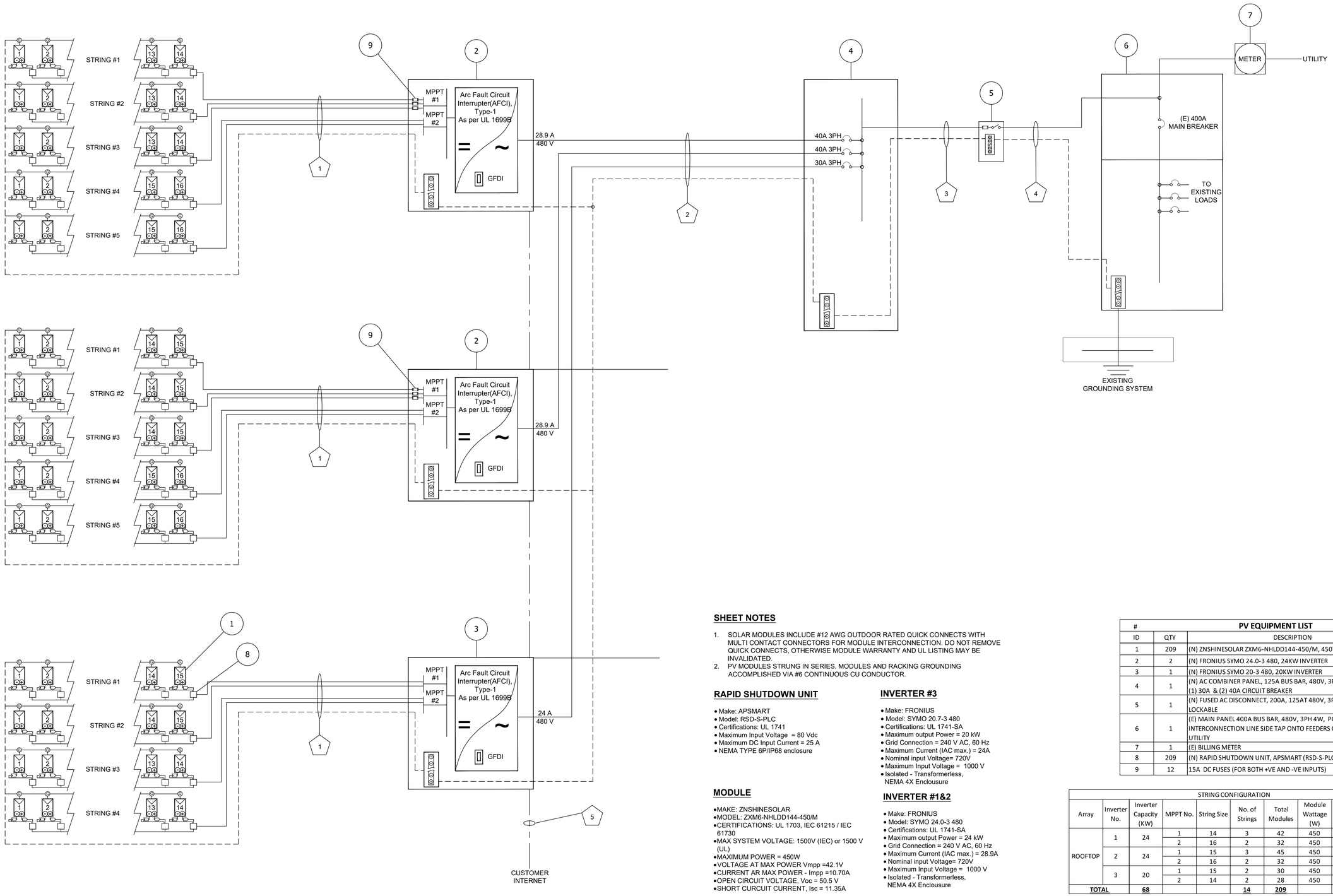
NAME OF CUSTOMER:
TITLE:
SUBJECT:
PROJECT LOCATION:

Rev #	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

Artisun Solar
12916 5TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

DWG NO: E-2

PROJ NO: NEI-210



SHEET NOTES

1. SOLAR MODULES INCLUDE #12 AWG OUTDOOR RATED QUICK CONNECTS WITH MULTI CONTACT CONNECTORS FOR MODULE INTERCONNECTION. DO NOT REMOVE QUICK CONNECTS, OTHERWISE MODULE WARRANTY AND UL LISTING MAY BE INVALIDATED.
2. PV MODULES STRUNG IN SERIES. MODULES AND RACKING GROUNDING ACCOMPLISHED VIA #6 CONTINUOUS CU CONDUCTOR.

RAPID SHUTDOWN UNIT

- Make: APSMART
- Model: RSD-S-PLC
- Certifications: UL 1741
- Maximum Input Voltage = 80 Vdc
- Maximum DC Input Current = 25 A
- NEMA TYPE 6P/IP68 enclosure

MODULE

- MAKE: ZNSHINESOLAR
- MODEL: ZXM6-NHLDD144-450/M
- CERTIFICATIONS: UL 1703, IEC 61215 / IEC 61730
- MAX SYSTEM VOLTAGE: 1500V (IEC) or 1500 V (UL)
- MAXIMUM POWER = 450W
- VOLTAGE AT MAX POWER Vmpp =42.1V
- CURRENT AR MAX POWER - Impp =10.70A
- OPEN CIRCUIT VOLTAGE, Voc = 50.5 V
- SHORT CURCUIT CURRENT, Isc = 11.35A

INVERTER #3

- Make: FRONIUS
- Model: SYMO 20.7-3 480
- Certifications: UL 1741-SA
- Maximum output Power = 20 kW
- Grid Connection = 240 V AC, 60 Hz
- Maximum Current (IAC max.) = 24A
- Nominal input Voltage= 720V
- Maximum Input Voltage = 1000 V
- Isolated - Transformerless, NEMA 4X Enclousure

INVERTER #1&2

- Make: FRONIUS
- Model: SYMO 24.0-3 480
- Certifications: UL 1741-SA
- Maximum output Power = 24 kW
- Grid Connection = 240 V AC, 60 Hz
- Maximum Current (IAC max.) = 28.9A
- Nominal input Voltage= 720V
- Maximum Input Voltage = 1000 V
- Isolated - Transformerless, NEMA 4X Enclousure

#	PV EQUIPMENT LIST	
ID	QTY	DESCRIPTION
1	209	(N) ZNSHINESOLAR ZXM6-NHLDD144-450/M, 450W SOLAR MODULE
2	2	(N) FRONIUS SYMO 24.0-3 480, 24KW INVERTER
3	1	(N) FRONIUS SYMO 20-3 480, 20KW INVERTER
4	1	(N) AC COMBINER PANEL, 125A BUS BAR, 480V, 3PH 4W, NEMA 3R WITH (1) 30A & (2) 40A CIRCUIT BREAKER
5	1	(N) FUSED AC DISCONNECT, 200A, 125AT 480V, 3PH 4W, NEMA 3R, LOCKABLE
6	1	(E) MAIN PANEL 400A BUS BAR, 480V, 3PH 4W, POINT OF INTERCONNECTION LINE SIDE TAP ONTO FEEDERS COMING FROM UTILITY
7	1	(E) BILLING METER
8	209	(N) RAPID SHUTDOWN UNIT, APSMART (RSD-S-PLC)
9	12	15A DC FUSES (FOR BOTH +VE AND -VE INPUTS)

STRING CONFIGURATION									
Array	Inverter No.	Inverter Capacity (KW)	MPPT No.	String Size	No. of Strings	Total Modules	Module Wattage (W)	Total DC Capacity (KW)	Module Count Per Inverter
ROOFTOP	1	24	1	14	3	42	450	18.9	74
			2	16	2	32	450	14.4	
	2	24	1	15	3	45	450	20.25	77
			2	16	2	32	450	14.4	
	3	20	1	15	2	30	450	13.5	58
			2	14	2	28	450	12.6	
TOTAL		68			14	209		94.05	

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SINGLE LINE DIAGRAM

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DWG NO: E-3

PROJ NO: NEI-210

WIRES AND CONDUIT SCHEDULE

TAG	INITIAL CONDUCTOR LOCATION	FINAL CONDUCTOR LOCATION	CONDUCTORS PER CONDUIT	CONDUIT	CONDUIT FILL %	OCPD	EGC PER CONDUIT	TEMP. CORR. FACTOR		# OF CURRENT CARYING CONDUCTORS	CONDUIT FILL FACTOR	CONT. CURRENT	MAX. CURRENT	BASE AMP	DERATED AMP	TERM. TEMP. RATING
1	ARRAY	INVERTER	(2) 12 AWG PV WIRE COPPER*	FREE AIR	NA	NA	(1) 6 AWG THWN-2 COPPER	0.91	38°C	NA	NA	9.43	15	30	27.3	90°C
2	INVERTER #1, #2	AC COMBINER PANEL	(3) #10 PHASE, (1) #10 NEUTRAL, THWN-2 COPPER	0.75" DIA. EMT	25.35%	40	(1) 6 AWG THWN-2 COPPER	0.91	38°C	3	1	28.9	36.125	40	36.4	90°C
2	INVERTER #3	AC COMBINER PANEL	(3) #10 PHASE, (1) #10 NEUTRAL, THWN-2 COPPER	0.75" DIA. EMT	25.35%	30	(1) 6 AWG THWN-2 COPPER	0.91	38°C	3	1	24	30	40	36.4	90°C
3	AC COMBINER PANEL	AC DISCONNECT	(3) #3 PHASE, (1) #3 NEUTRAL, THWN-2 COPPER	1.25" DIA EMT	29.41%	125	(1) 6 AWG THWN-2 COPPER	0.91	38°C	3	1	82	102.25	115	104.65	90°C
4	AC DISCONNECT	MSP	(3) #3 PHASE, (1) #3 NEUTRAL, THWN-2 COPPER	1.25" DIA EMT	29.41%	125	(1) 6 AWG THWN-2 COPPER	0.91	38°C	3	1	82	102.25	115	104.65	90°C
5	CAT 5E COMMUNICATION WIRE FOR INVERTER SHALL BE INSTALLED IN SEPARATE CONDUIT OR OUTDOOR RATED AND ROUTED TO CLIENT INTERNET ROUTER															

* 1000V RATED

SYSTEM PROPERTIES		
No Of Modules	209	Nos
Max. Ambient temp @ Site	38	◦C
Min Ambient Temp @ site	-17.7	◦C
STC Temp	25	◦C
No of Modules in a String	16	Nos
Ambient temp (for cable sizin	36-40	◦C

Module	ZNSHINE SOLAR	
Module Power	450	W
Module Voc	50.5	V
Module Vmp	42.1	V
Module Isc	11.35	A
Module Imp	10.7	A
Temp Coeffeicient for Voc	-0.29%	%/◦C
Temp Coeffeicient for Vmp	-0.29%	%/◦C
Temp Coeffeicient for Isc	0.05%	%/◦C
Max. System Voltage	1500	V

Maximum System Voltage		
No of Modules in a String	16	
No of Strings	4	Nos
Voc @ Max. Ambient	48.60	V
Voc@ Min. Ambient	56.75	V
Vmp @ Max. Ambient	40.51	V
Vmp @ Min. Ambient	47.31	V
MPPT Lower Range	648.21	V
MPPT Upper Range	757.01	V
Min. Operating Voltage	648.21	V
Max. Operating Voltage	**757.01**	**V**
ISC/String	11.35	A
Isc @ Max. Ambient	11.42	A
Isc @ Min. Ambient	11.11	A
Max. System Voltage	**908.05**	**V**

Maximum System Voltage		
No of Modules in a String	15	
No of Strings	5	Nos
Voc @ Max. Ambient	48.60	V
Voc@ Min. Ambient	56.75	V
Vmp @ Max. Ambient	40.51	V
Vmp @ Min. Ambient	47.31	V
MPPT Lower Range	607.69	V
MPPT Upper Range	709.70	V
Min. Operating Voltage	607.69	V
Max. Operating Voltage	**709.70**	**V**
ISC/String	11.35	A
Isc @ Max. Ambient	11.42	A
Isc @ Min. Ambient	11.11	A
Max. System Voltage	**851.30**	**V**

Maximum System Voltage		
No of Modules in a String	14	
No of Strings	5	Nos
Voc @ Max. Ambient	48.60	V
Voc@ Min. Ambient	56.75	V
Vmp @ Max. Ambient	40.51	V
Vmp @ Min. Ambient	47.31	V
MPPT Lower Range	567.18	V
MPPT Upper Range	662.39	V
Min. Operating Voltage	567.18	V
Max. Operating Voltage	**662.39**	**V**
ISC/String	11.35	A
Isc @ Max. Ambient	11.42	A
Isc @ Min. Ambient	11.11	A
Max. System Voltage	**794.55**	**V**

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WIRE SCHEDULE & CALCULATIONS

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DWG NO: E-4

PROJ NO: NEI-210

ALL LABEL MATERIAL SHALL BE WEATHER RESISTANT AND SUITABLE FOR THE ENVIRONMENT. LETTERS SHALL BE CAPITALIZED WITH A MIN. HEIGHT OF 3/8" (9.5MM) WHITE ON RED BACKGROUND. NOT ALL LABLES WILL BE APPLICABLE TO EVERY PROJECT

INCLUDE THE FOLLOWING LABELS ON ALL CONDUIT CONTAINING DC CONDUCTORS

PLACE EVERY 10' AND AFTER EACH BEND ON CONDUIT
PVLABELS.COM PLACARD 02-329

CAUTION: SOLAR CIRCUIT

INCLUDE THE FOLLOWING LABELS ON ALL SERVICEABLE EQUIPMENT

PVLABELS.COM LABEL 05-580

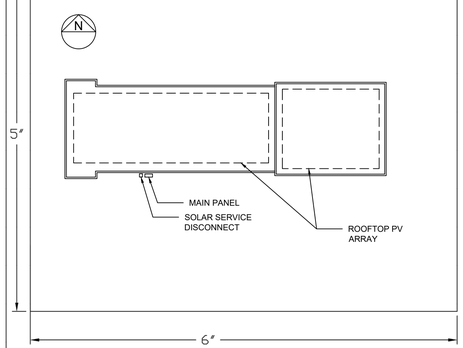
INCLUDE THE FOLLOWING LABELS ON ALL ROOFTOP DC JUNCTION BOXES

PVLABELS.COM LABEL 03-102

INCLUDE THE FOLLOWING LABELS ON UTILITY METER

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

CAUTION: POWER TO THIS BUILDING IS ALSO SUPPLIED FROM THE FOLLOWING SOURCES WITH A DISCONNECT LOCATED AS SHOWN

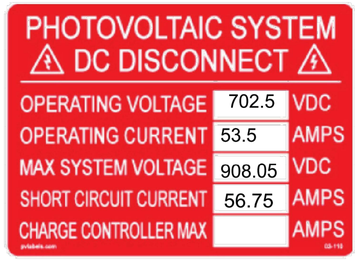


PVLABELS.COM LABEL 03-211

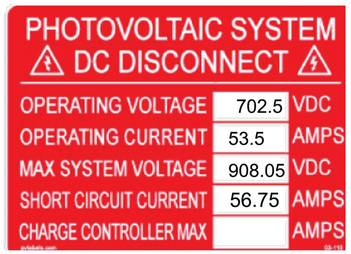
INCLUDE THE FOLLOWING LABELS ON INVERTERS

PVLABELS.COM LABEL 03-110

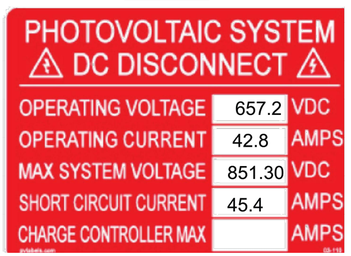
INVERTER #1



INVERTER #2



INVERTER #3



PVLABELS.COM LABEL 03-102

INCLUDE THE FOLLOWING LABELS ON POINT OF INTERCONNECTION EQUIPMENT

PVLABELS.COM LABEL 03-211

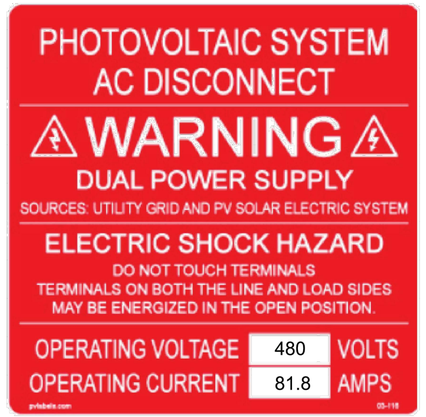
PVLABELS.COM LABEL 03-344

PVLABELS.COM LABEL 03-326

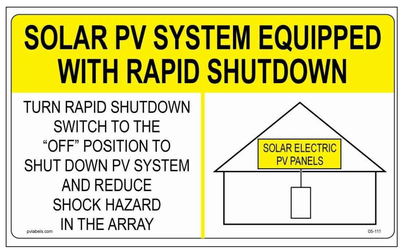
INCLUDE THE FOLLOWING LABELS ON AC DISCONNECTS

PVLABELS.COM LABEL 03-116

SYSTEM #1



PVLABELS.COM LABEL 02-316



STATE OF MISSOURI
GERALD H. CRAFTON
NUMBER PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop
LABELS
94.05 KW DC Rooftop Photovoltaic System
2100 NE Independence Ave, Lee's Summit, MO 64064, USA

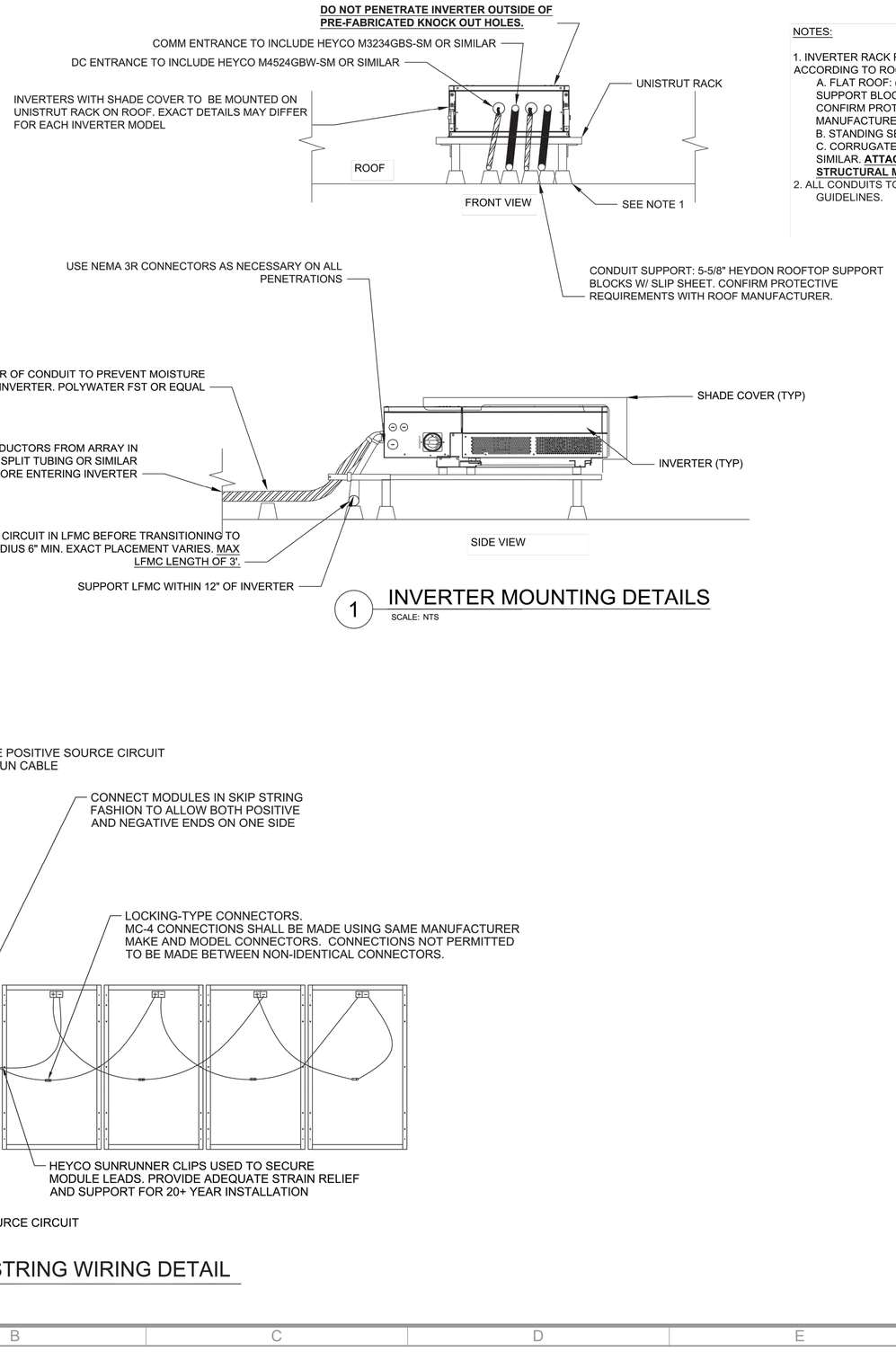
NAME OF CUSTOMER:
TITLE:
SUBJECT:
PROJECT LOCATION:

Rev #	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

Artisun Solar
12916 6TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

DWG NO: E-5

PROJ NO: NEI-210

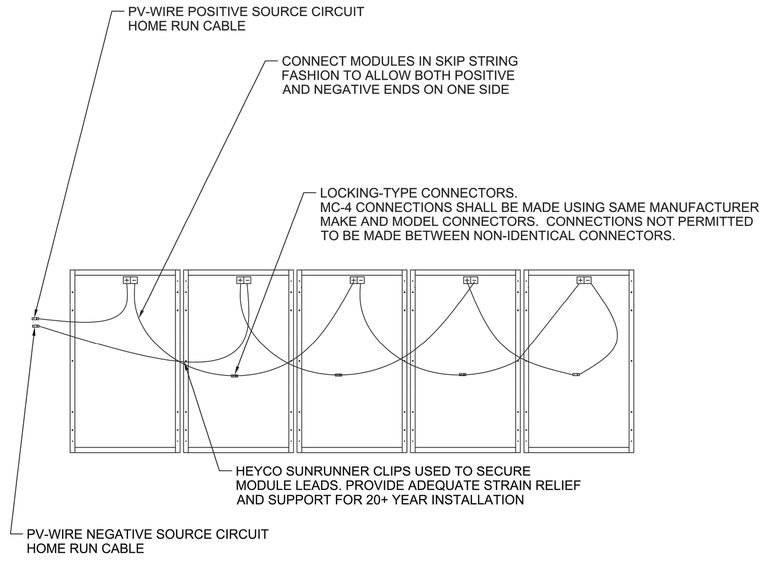


NOTES:

1. INVERTER RACK ROOF ATTACHMENT WILL VARY ACCORDING TO ROOF TYPE ACCORDINGLY:
   A. FLAT ROOF: (4) 5-5/8" HEYDON ROOFTOP SUPPORT BLOCKS OR SIMILAR W/ SLIP SHEET. CONFIRM PROTECTIVE REQUIREMENTS WITH ROOF MANUFACTURER.
   B. STANDING SEAM: (4) S5 U CLAMPS CLAMPS
   C. CORRUGATED METAL: (4) VERSABRACKETS OR SIMILAR. **ATTACHMENT MUST LAND ON ROOF STRUCTURAL MEMBER**.
2. ALL CONDUITS TO BE PROPERLY BONDED PER NEC GUIDELINES.

1 INVERTER MOUNTING DETAILS

SCALE: NTS



2 PV STRING WIRING DETAIL

NTS

STATE OF MISSOURI
GERALD H. SHARLTON
NUMBER PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop

EQUIPMENT DETAIL

94.05 KW DC Rooftop Photovoltaic System

2100 NE Independence Ave, Lee's Summit, MO 64064, USA

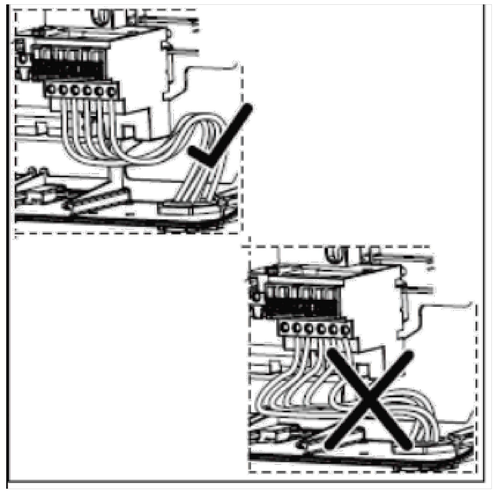
NAME OF CUSTOMER:
TITLE:
SUBJECT:
PROJECT LOCATION:

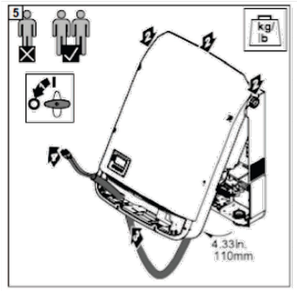
Rev #	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

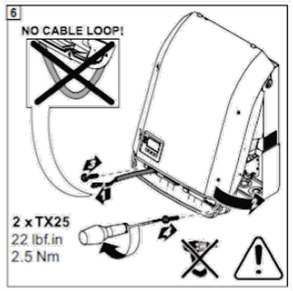
Artisun Solar
12916 5TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

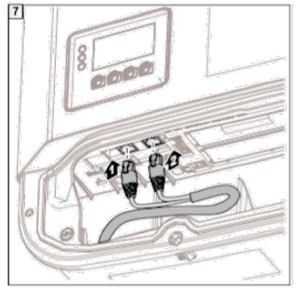
DWG NO: E-6

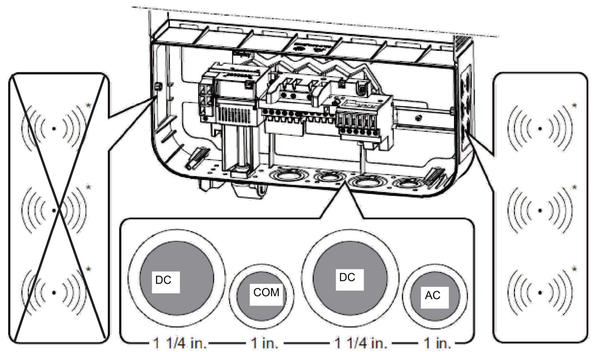
PROJ NO: NEI-210









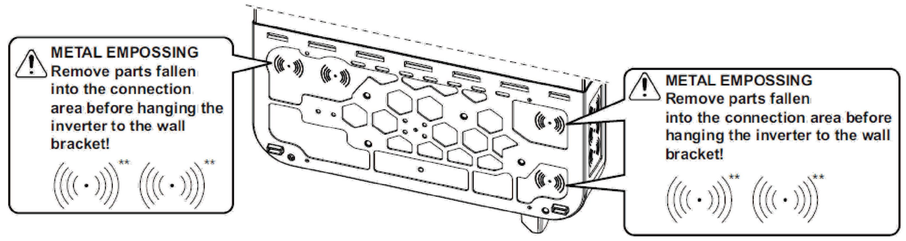


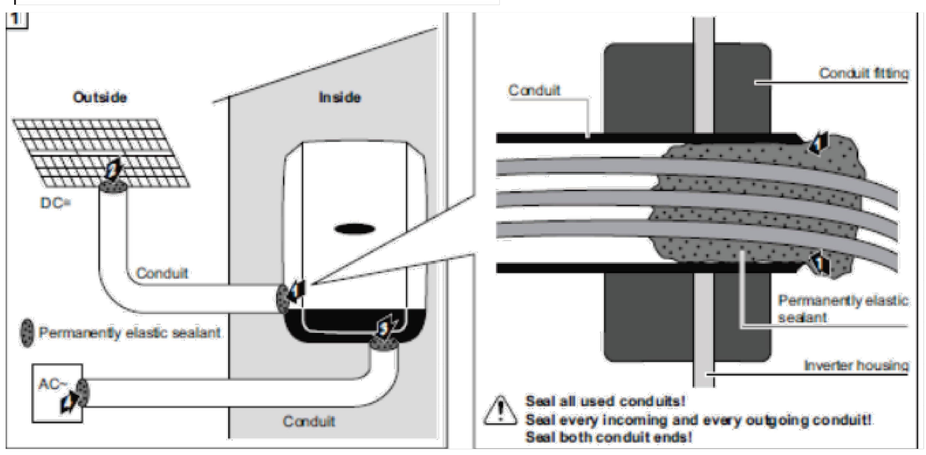
1/2 in. ... DATCOM

3/4 in. - 1 1/4 in. ... AC ~ / DC =

* Conduit size
1/2 in. / 3/4 in. / 1 in.

** Conduit size
1/2 in. / 3/4 in. / 1 in. / 1 1/4 in.





1 INSTALLATION MANUAL DETAILS
NTS

STATE OF MISSOURI
GERALD H. GRAYSTON
NUMBER PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop

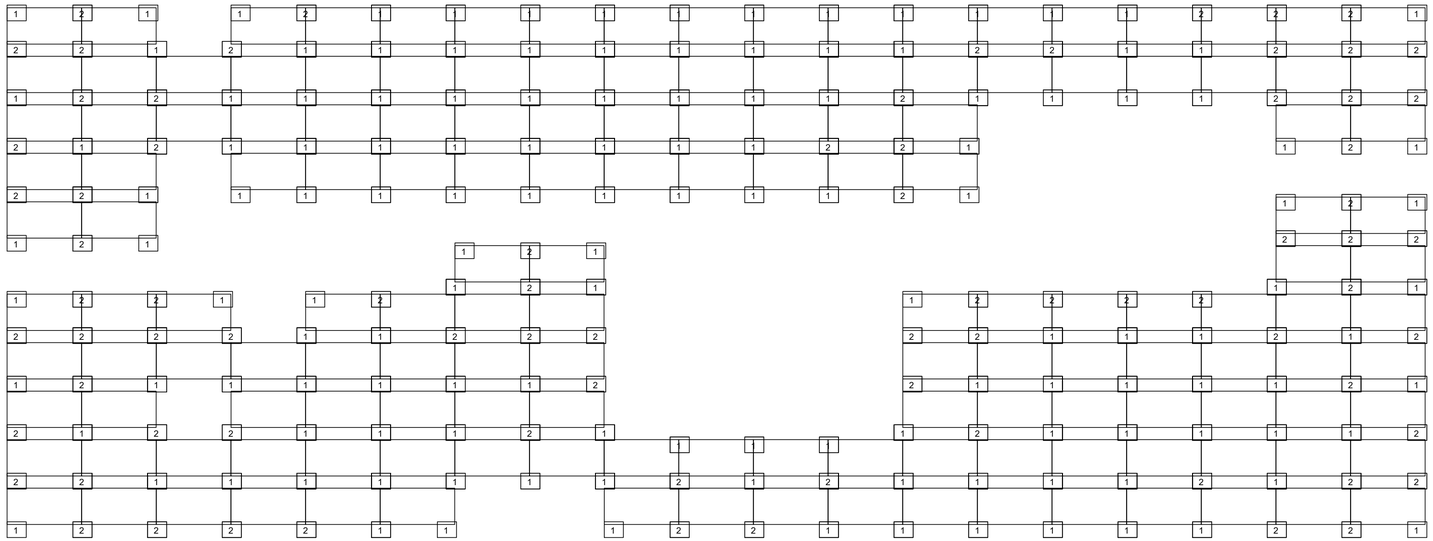
EQUIPMENT DETAIL

94.05 KW DC Rooftop Photovoltaic System
2100 NE Independence Ave, Lee's Summit, MO 64064, USA

Rev #	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

Artisun Solar
12916 6TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

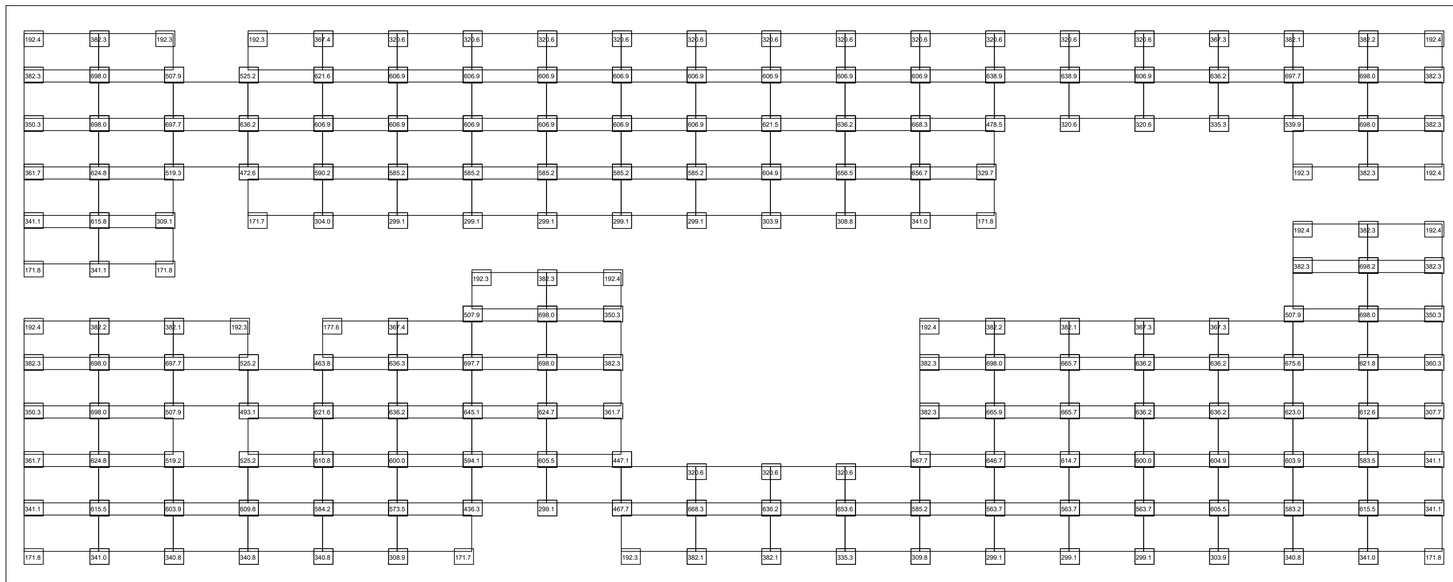
DWG NO: E-7
PROJ NO: NEI-210



BALLAST LEGEND

[#] # OF BLOCKS PER TRAY

BALLAST MAP



Legend

[N] Bay - Downpoint load

[N] Bay - Maximum downpoint load

DOWNPOINT LOAD MAP

1 RACKING LAYOUT

Scale: 1/8"=1'

GERALD H. GRAYLON NUMBER PE-2004020052 PROFESSIONAL ENGINEER

STATE OF MISSOURI

7/6/2022

Lee's Summit Detail Shop

STRUCTURAL DRAWING

94.05 KW DC Rooftop Photovoltaic System

2100 NE Independence Ave, Lee's Summit, MO 64064, USA

NAME OF CUSTOMER:

TITLE:

SUBJECT:

PROJECT LOCATION:

Rev #	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

Artisun Solar
12916 5TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

DWG NO: S-1

PROJ NO: NEI-210

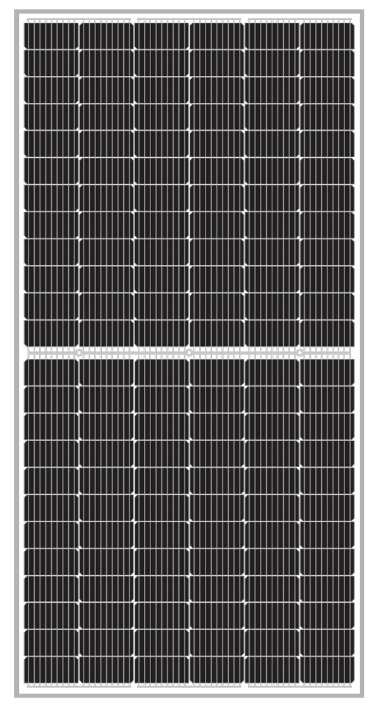
ZXM6-NHLDD144 Series

Znshinesolar 9BB **HALF-CELL Bifacial** Light-Weight Double Glass Mono PV Module

ZNSHINESOLAR

Mono Poly Solutions

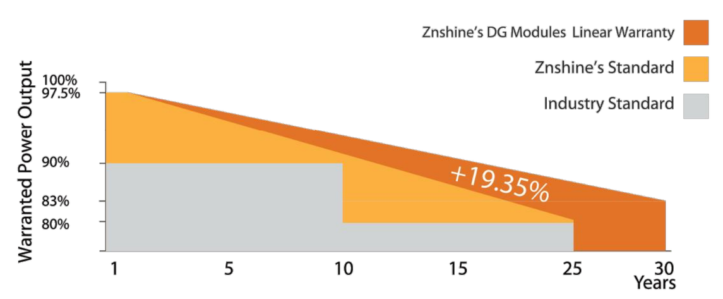
425W | 430W | 435W | 440W | 445W | 450W



Made with selected materials and components to ensure quality, longevity, efficiency and stable outputs, the ZXM6-NHLDD144 monocrystalline modules by ZNSHINE SOLAR represents a highly flexible solution for diverse installation types, from small home PV systems to industrial rooftop plants to large utility arrays.
ZNSHINE SOLAR' S ZXM6-NHLDD144 monocrystalline solar modules are tested and approved by internationally recognized laboratories so that we can offer our global customers a reliable and price-quality optimized product. The linear warranty on the product output further secures increased stability and financial returns on investments over time.

12 years product warranty/30 years output warranty

0.5% Annual Degradation over 30 years



More power output
Module RS decreases, FF (fill factor) increases, power gain is stable above 1.5%, and can be increased by 5~10W

High Efficiency
A high efficiency PERC solar cell with 9 busbars technology to ensure the efficiency of the solar module up to 20.70% and stable operation

Anti PID
Limited power degradation of ZXM6-NHLDD144 module caused by PID effect is guaranteed under strict testing condition for mass production

Better Weak Illumination Response
Lower temperature coefficient and wide spectral response, higher power output, even under low-light settings

Bifacial technology
Enables additional energy harvesting from rear side(up to 25%)

Grahpene Coating(Optional*)
Graphene coating modules can increase power generation and self-cleaning, also can save maintainance cost
* Can be customized

ZNShine PV-Tech Co., LTD, founded in 1988, is a world-leading high-performance PV module manufacturer, PV power station developer, EPC and power station operator. With its state-of-the-art production lines, the company boasts module output of 5GW. Bloomberg has listed ZNShine as a global Tier 1 PV manufacturer and Top 4 reliable PV supplier.
www.znshinesolar.com

ZXM6-NHLDD144 Series | Znshinesolar 9BB HALF-CELL Bifacial Light-Weight Double Glass Mono PV Module

ELECTRICAL PROPERTIES | STC*

Module Type	ZXM6-NHLDD144-425/M	ZXM6-NHLDD144-430/M	ZXM6-NHLDD144-435/M	ZXM6-NHLDD144-440/M	ZXM6-NHLDD144-445/M	ZXM6-NHLDD144-450/M
Nominal Power Watt Pmax(W)	425	430	435	440	445	450
Power Output Tolerance Pmax(%)	0~+3	0~+3	0~+3	0~+3	0~+3	0~+3
Maximum Power Voltage Vmp(V)	41.1	41.3	41.5	41.7	41.9	42.1
Maximum Power Current Imp(A)	10.35	10.42	10.49	10.56	10.63	10.70
Open Circuit Voltage Voc(V)	49.5	49.7	49.9	50.1	50.3	50.5
Short Circuit Current Isc(A)	11.00	11.07	11.14	11.21	11.28	11.35
Module Efficiency (%)	19.55	19.78	20.01	20.24	20.47	20.70

*STC (Standard Test Condition): Irradiance 1000W/m², Module Temperature 25℃, AM 1.5
*The data above is for reference only and the actual data is in accordance with the pratical testing

ELECTRICAL PROPETIES | NOCT/NMOT*

Maximum Power Pmax(Wp)	316.7	320.3	323.9	327.6	330.6	334.3
Maximum Power Voltage Vmpp(V)	38.0	38.2	38.4	38.5	38.7	38.9
Maximum Power Current Impp(A)	8.34	8.39	8.44	8.50	8.53	8.58
Open Circuit Voltage Voc(V)	46.1	46.3	46.5	46.6	46.8	47.0
Short Circuit Current Isc(A)	8.88	8.94	8.99	9.05	9.11	9.17

*NMOT(Nominal module operating temperature):Irradiance 800W/m²,Ambient Temperature 20℃,AM 1.5,Wind Speed 1m/s
*The data above is for reference only and the actual data is in accordance with the pratical testing

Electrical characteristics with 25% rear side power gain

Front power Pmax/W	425	430	435	440	445	450
Total power Pmax/W	531	538	544	550	556	562
Vmp/V(Total)	41.2	41.4	41.6	41.8	42.0	42.2
Imp/A(Total)	12.89	13.00	13.08	13.16	13.24	13.32
Voc/V(Total)	49.6	49.8	50.0	50.2	50.4	50.6
Isc/A(Total)	13.54	13.65	13.73	13.81	13.89	13.97

TEMPERATURE RATINGS

NMOT	44℃ ±2℃
Temperature coefficient of Pmax	-0.36%/℃
Temperature coefficient of Voc	-0.29%/℃
Temperature coefficient of Isc	0.05%/℃
Refer.Bifacial Factor	70±5%

*Do not connect Fuse in Combiner Box with two or more strings in parallel connection

WORKING CONDITIONS

Maximum system voltage	1500 V DC
Operating temperature	-40℃~+85℃
Maximum series fuse	20 A
Maximum load(snow/wind)	5400 Pa / 2400 Pa

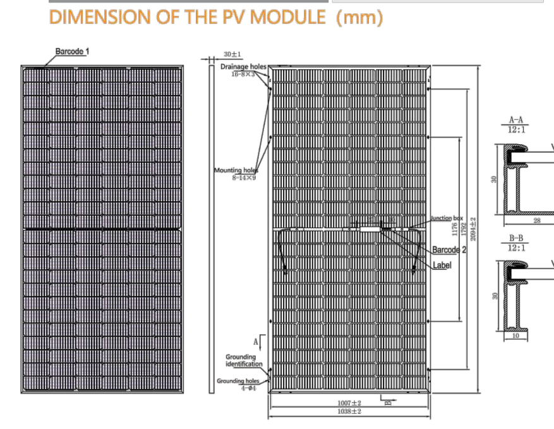
MECHANICAL DATA

Solar cells	Mono 166*83mm
No. of Cells	144 (6×24)
Module dimension	2094×1038×30 mm(With Frame)
Weight	28 kg
Glass	2.0mm+2.0mm heat strengthened glass
Junction box	IP 68, 3 diodes
Cables	4 mm² ,350 mm or Customized Length
Connectors	MC4-compatible or Customized Connectors

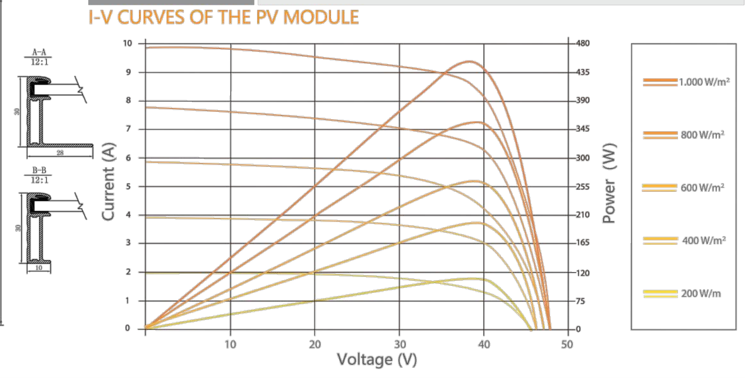
PACKAGING INFORMATION

Packing Type	40' HQ
Piece/Box	36
Piece/Container	792

DIMENSION OF THE PV MODULE (mm)



I-V CURVES OF THE PV MODULE



Add : 1#, Zhixi Industrial Zone, JintanJiangsu 213251, P.R. China
Tel: +86 519 6822 0233 E-mail: info@znshinesolar.com

Remark: please read safety and installation instructions before using the product | Subject to change without prior notice © ZNSHINE SOLAR 2020 | Version: ZXM6-NHLDD144-2007.E

APsmart

Raising the bar in innovative DC **MLPE** solar power systems

RSD-S-PLC

- Meets NEC 2017 & 2020 (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.

RSD-S-PLC TECHNICAL DATA

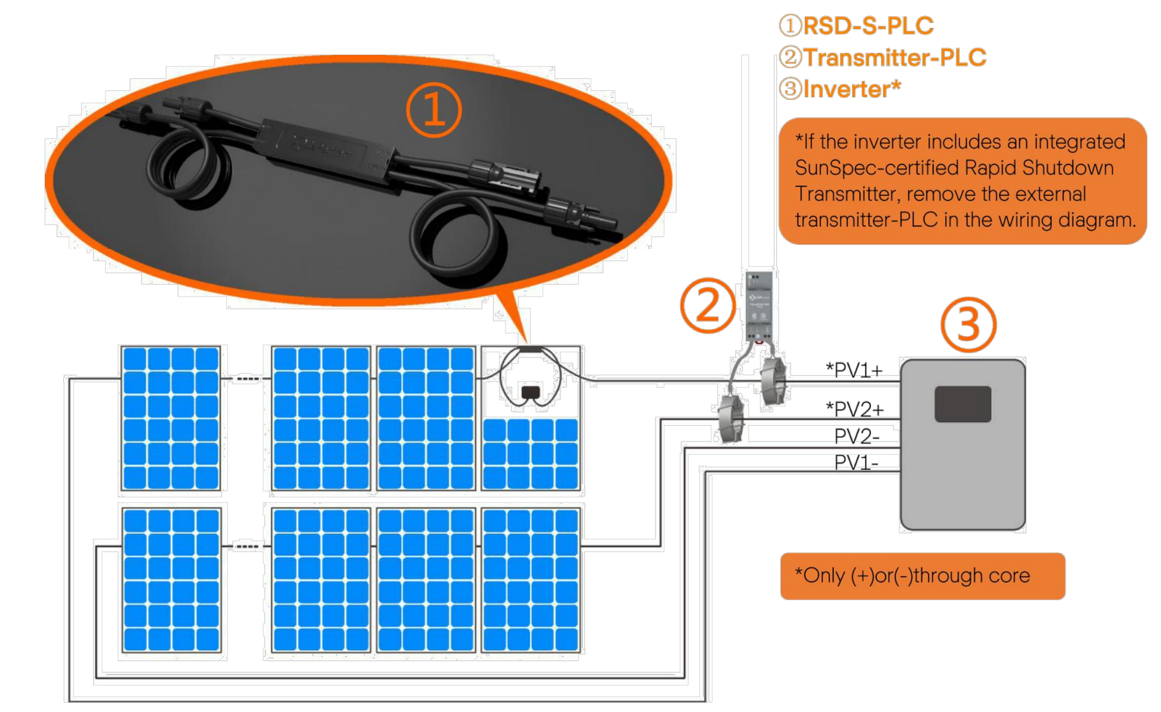
MODEL	RSD-S-PLC
INPUT DATA (DC)	
Input Operating Voltage Range	8-80V
Maximum Cont. Input Current (Imax)	15A
Maximum Short Circuit Current（Isc）	25A
OUTPUT DATA (DC)	
Output Operating Voltage Range	8-80V
Maximum System Voltage	1000V/1500V
Maximum Series Fuse Rating	30A
MECHANICAL DATA	
Operating Ambient Temperature Range	-40℉ to +185℉ (-40 °C to + 85 °C)
Dimensions (without cable & connectors)	5" x 1.2" x 0.6"(129 mm x 30 mm x 16 mm)
Cable Length	Input 250mm/Output 1200mm
Cable Cross Section Size	UL:12AWG
Connector	Stäubli MC4 PV-KBT4&KST4 or Customize
Enclosure Rating	NEMA Type 6P/IP68
Over Temperature Protection	Yes
FEATURES & COMPLIANCE	
Communication	PLC
Safety Compliance	NEC 2017 & 2020 (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

Rapid Shutdown CERTIFIED

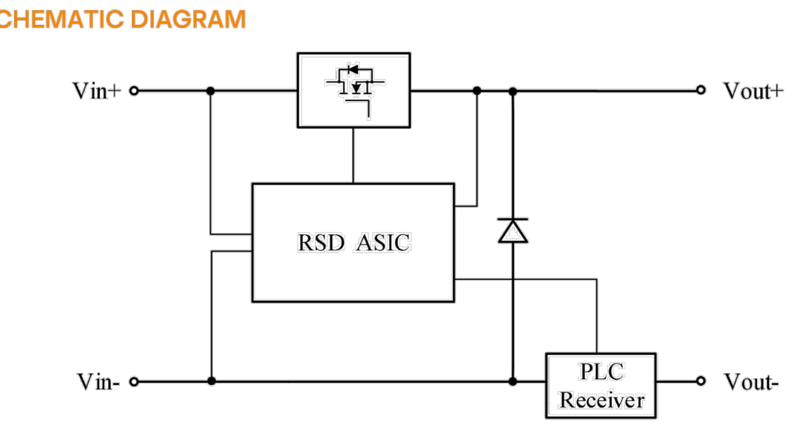
REV 2.3 2021-11-11

APsmart

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

APsmart
600 Ericksen Ave NE, Suite 200 Seattle, WA 98110 | +1-737-218-8486 |
+1-866-374-8538 | support@APsmartGlobal.com | APsmartGlobal.com

REV 2.3 2021-11-11

/ Perfect Welding / Solar Energy / Perfect Charging

Fronius

FRONIUS SYMO ADVANCED

Powering three-phase projects that last - now with integrated SunSpec PLC

PC board replacement concept | SnapINverter Technology | Integrated Data Communication | Smart Grid Ready | SuperFlex Design | Power Line Communication

Featuring ten models ranging from 10 kW to 24 kW, the Fronius Symo Advanced is the ideal inverter for commercial applications.

The new Advanced versions combine the benefits of the Fronius Symo with additional value for states with Module Level Shutdown requirements including integrated PLC transmitter for SunSpec Rapid Shutdown communication standard, compliance with NEC pre-2014, 2014 and 2017, zero tilt mounting, light weight and field serviceability.

TECHNICAL DATA FRONIUS SYMO ADVANCED (208-240 V VERSIONS)

INPUT DATA	SYMO 10.0-3 208-240		SYMO 12.0-3 208-240	
	208 V	240 V	208 V	240 V
Max. PV generator output ($P_{dc\ max}$)	15 kW$_{peak}$		18 kW$_{peak}$	
Max. input current ($I_{dc\ max1}$ / $I_{dc\ max2}$)	25 A / 16.5 A			
Max. array short circuit current (MPP1 / MPP2)	37.5 A / 24.8 A			
Nominal input voltage	350 V	370 V	350 V	370 V
DC input voltage range ($U_{dc\ min}$ + $U_{dc\ max}$)	200 - 600 V			
Feed-in start voltage ($U_{dc\ start}$)	200 V			
Usable MPP voltage range ($U_{mpp\ min}$ + $U_{mpp\ max}$)	300 - 500 V			
Max. input voltage	600 V			
Admissable conductor size DC	AWG 14-AWG 6 copper direct, AWG 6 aluminum direct, AWG 4-AWG 2 copper or aluminum with input combiner			
Number of MPP trackers	2			

OUTPUT DATA	SYMO 10.0-3 208-240		SYMO 12.0-3 208-240	
	208 V	240 V	208 V	240 V
AC nominal output ($P_{ac,r}$)	9,995 W		11,995 W	
Max. output power	9,995 VA		11,995 VA	
Output configuration	208 / 240 V			
Frequency range (f_{min} - f_{max})	45 - 60 Hz			
Admissable conductor size AC	AWG 14 - AWG 6			
Total harmonic distortion	< 1.5 %		< 1.75 %	
Power factor (cos $\phi_{ac,r}$)	0-1 ind. / cap.			
Max. continuous output current	27.7 A	24 A	33.3 A	28.9 A
OCPD/AC breaker size	35 A	30 A	45 A	40 A

EFFICIENCY	SYMO 10.0-3 208-240		SYMO 12.0-3 208-240	
	208 V	240 V	208 V	240 V
Max. Efficiency	97.0 %			
CEC Efficiency	96.5 %		96.5 %	

TECHNICAL DATA FRONIUS SYMO (208-240 V VERSIONS)

GENERAL DATA — SYMO 10.0-3 208-240 | SYMO 12.0-3 208-240

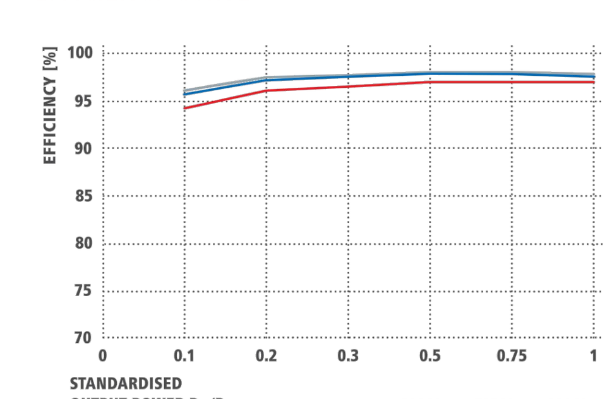
PROTECTIVE DEVICES — SYMO 10.0-3 208-240 | SYMO 12.0-3 208-240

INTERFACES — SYMO 10.0-3 208-240 | SYMO 12.0-3 208-240

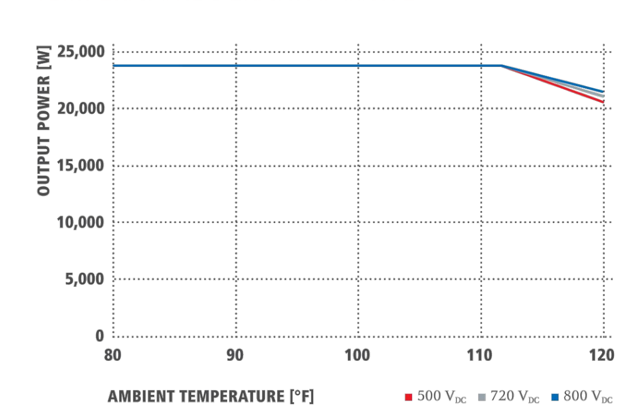
TECHNICAL DATA FRONIUS SYMO (480 V VERSIONS)

INPUT DATA — SYMO 15.0-3 480 | SYMO 20.0-3 480 | SYMO 22.7-3 480 | SYMO 24.0-3 480

FRONIUS SYMO 24.0-3 480 CEC EFFICIENCY CURVE



FRONIUS SYMO 24.0-3 480 TEMPERATURE DERATING CURVE



TECHNICAL DATA FRONIUS SYMO (480 V VERSIONS)

OUTPUT DATA	SYMO 15.0-3 480	SYMO 20.0-3 480	SYMO 22.7-3 480	SYMO 24.0-3 480
AC nominal Ouput ($P_{ac,r}$)	14,995 W	19,995 W	22,727 W	23,995 W
Max. ouput power	14,995 VA	19,995 VA	22,727 VA	23,995 VA
Grid connection	480 / 277 V WYE[3]			
Frequency (frequency range f_{min} - f_{max})	60 Hz (45 - 65 Hz)			
Admissable conductor size (AC)	AWG 14-AWG 6			
Total harmonic distortion	< 1.5 %	< 1 %	< 1.25 %	< 1 %
Power factor ($C_{os\ ac,r}$)	0-1 ind. / cap.			
Max. continuous output current	18 A	24 A	27.3 A	28.9 A
OCPD/AC breaker size	25 A	30 A	35 A	40 A

EFFICIENCY	SYMO 15.0-3 480	SYMO 20.0-3 480	SYMO 22.7-3 480	SYMO 24.0-3 480
Max. Efficiency	98 %			
CEC Efficiency	97 %	97.5 %		

GENERAL DATA — SYMO 15.0-3 480 | SYMO 20.0-3 480 | SYMO 22.7-3 480 | SYMO 24.0-3 480

PROTECTIVE DEVICES — SYMO 15.0-3 480 | SYMO 20.0-3 480 | SYMO 22.7-3 480 | SYMO 24.0-3 480

INTERFACES — SYMO 15.0-3 480 | SYMO 20.0-3 480 | SYMO 22.7-3 480 | SYMO 24.0-3 480

/ Perfect Welding / Solar Energy / Perfect Charging

THREE BUSINESS UNITS, ONE GOAL: TO SET THE STANDARD THROUGH TECHNOLOGICAL ADVANCEMENT.

Fronius USA LLC | Fronius International GmbH

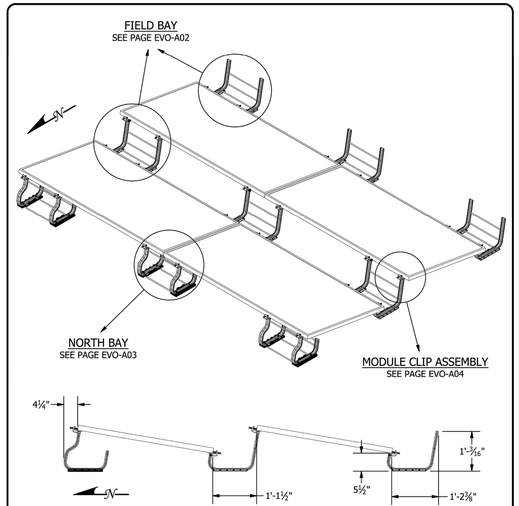
STATE OF MISSOURI — GERALD L. CHARLTON — NUMBER PE-2004000052 — PROFESSIONAL ENGINEER
7/6/2022

NAME OF CUSTOMER:	Lee's Summit Detail Shop
TITLE:	EQUIPMENT DATA SHEET
SUBJECT:	94.05 KW DC Rooftop Photovoltaic System
PROJECT LOCATION:	2100 NE Independence Ave, Lee's Summit, MO 64064, USA

Rev #	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

Artisun Solar
12916 5TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

DWG NO: D-1
PROJ NO: NEI-210

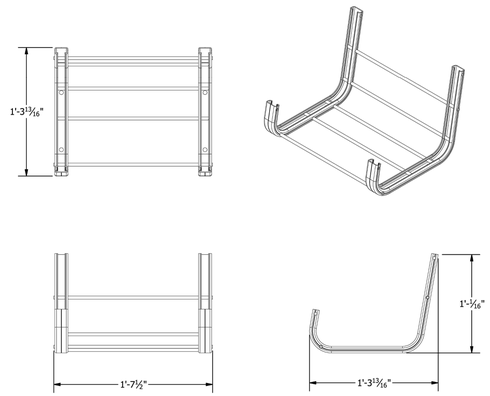


PROFILE VIEW

NOTES:
1. ARRAY DIMENSIONS WILL VARY BASED ON MODULE WIDTH, LENGTH AND RETURN FLANGE.

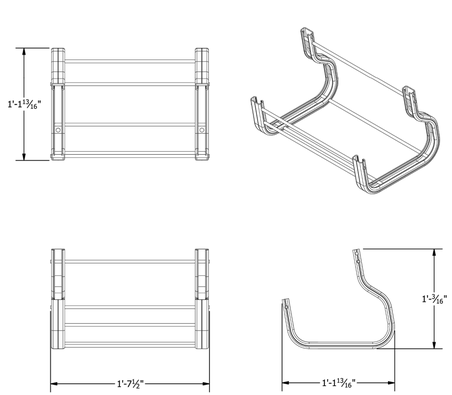
UNIRAC			
1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE:	RM10 EVO	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL
	DRAWING TYPE:	SYSTEM ASSEMBLY	PRODUCT PROTECTED BY ONE OR MORE US PATENTS
	DESCRIPTION:	RM10 EVO	LEGAL NOTICE
	REVISION DATE:	12/10/2021	EVO-A01 SHEET

ASSEMBLY # TABLE	
P/N	DESCRIPTION
370010	RM10 EVO FIELD BAY



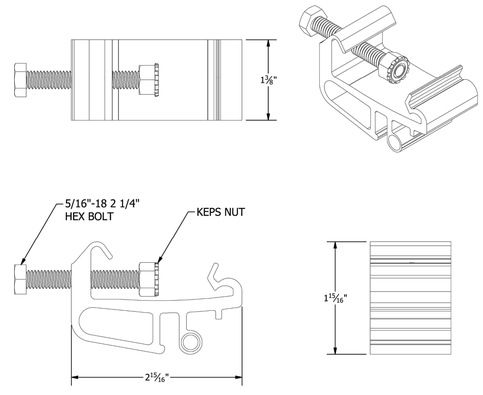
UNIRAC			
1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE:	RM10 EVO	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL
	DRAWING TYPE:	PARTS ASSEMBLY	PRODUCT PROTECTED BY ONE OR MORE US PATENTS
	DESCRIPTION:	FIELD BAY ASSEMBLY	LEGAL NOTICE
	REVISION DATE:	12/10/2021	EVO-A02 SHEET

ASSEMBLY # TABLE	
P/N	DESCRIPTION
370011	RM10 EVO NORTH ROW BAY



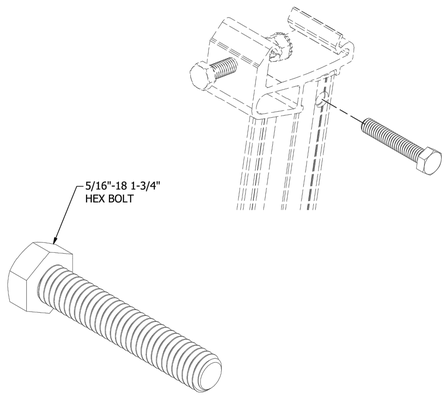
UNIRAC			
1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE:	RM10 EVO	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL
	DRAWING TYPE:	PARTS ASSEMBLY	PRODUCT PROTECTED BY ONE OR MORE US PATENTS
	DESCRIPTION:	NORTH BAY ASSEMBLY	LEGAL NOTICE
	REVISION DATE:	12/10/2021	EVO-A03 SHEET

ASSEMBLY # TABLE	
P/N	DESCRIPTION
370023	RM10 EVO MODULE CLIP W/BOLT

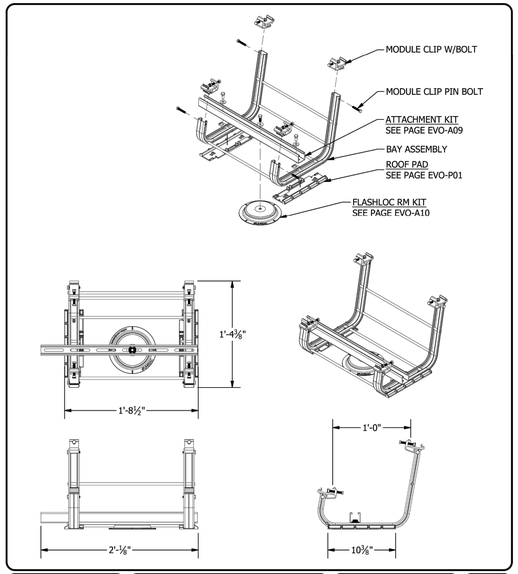


UNIRAC			
1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE:	RM10 EVO	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL
	DRAWING TYPE:	PARTS ASSEMBLY	PRODUCT PROTECTED BY ONE OR MORE US PATENTS
	DESCRIPTION:	MODULE CLIP ASSEMBLY	LEGAL NOTICE
	REVISION DATE:	12/10/2021	EVO-A04 SHEET

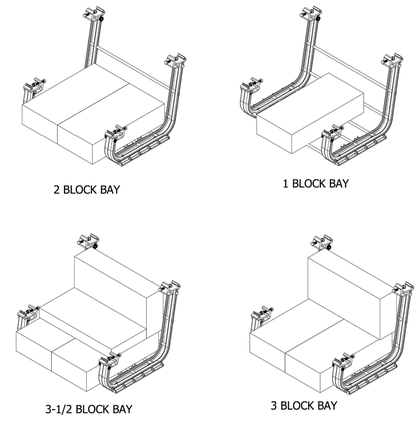
ASSEMBLY # TABLE	
P/N	DESCRIPTION
370022	RM10 EVO MODULE CLIP PIN BOLT



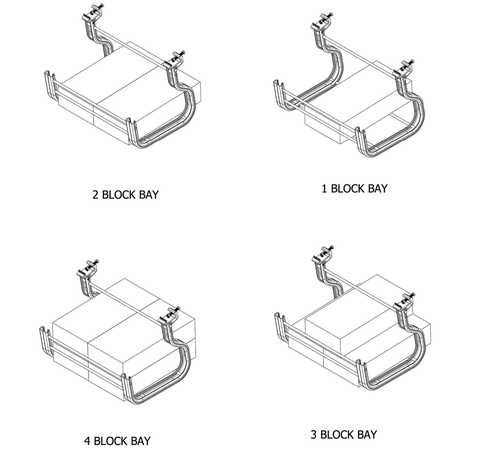
UNIRAC			
1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE:	RM10 EVO	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL
	DRAWING TYPE:	PARTS	PRODUCT PROTECTED BY ONE OR MORE US PATENTS
	DESCRIPTION:	MODULE CLIP PIN BOLT	LEGAL NOTICE
	REVISION DATE:	12/10/2021	EVO-A05 SHEET



UNIRAC			
1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE:	RM10 EVO	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL
	DRAWING TYPE:	PARTS ASSEMBLY	PRODUCT PROTECTED BY ONE OR MORE US PATENTS
	DESCRIPTION:	ROOF ATTACHMENT ASSEMBLY	LEGAL NOTICE
	REVISION DATE:	12/10/2021	EVO-A06 SHEET



UNIRAC			
1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE:	RM10 EVO	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL
	DRAWING TYPE:	PARTS ASSEMBLY	PRODUCT PROTECTED BY ONE OR MORE US PATENTS
	DESCRIPTION:	FIELD BAY BALLAST LAYOUT	LEGAL NOTICE
	REVISION DATE:	12/10/2021	EVO-A07 SHEET



UNIRAC			
1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE:	RM10 EVO	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL
	DRAWING TYPE:	PARTS ASSEMBLY	PRODUCT PROTECTED BY ONE OR MORE US PATENTS
	DESCRIPTION:	NORTH BAY BALLAST LAYOUT	LEGAL NOTICE
	REVISION DATE:	12/10/2021	EVO-A08 SHEET

STATE OF MISSOURI
GERALD H. SHARLTON
NUMBER PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop

EQUIPMENT DATA SHEET

94.05 KW DC Rooftop Photovoltaic System

2100 NE Independence Ave, Lee's Summit, MO 64064, USA

NAME OF CUSTOMER:	TITLE:	SUBJECT:	PROJECT LOCATION:

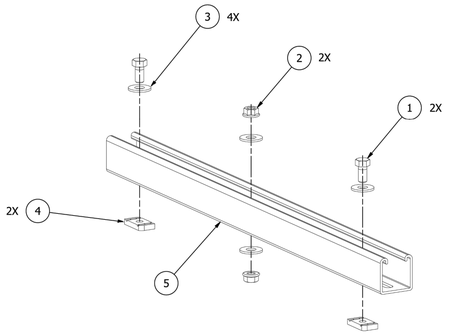
Rev.#	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

Artisun Solar
12916 5TH ST
GRANDVIEW, MO 64030
PH: (913) 601-4700

DWG NO: D-2

PROJ NO: NEI-210

ASSEMBLY # TABLE	
P/N	DESCRIPTION
310771	RM10 ATTACHMENT KIT



ATACHMENT PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	M30304	3/8-16 X 3/4 HEX BOLT, SS
2	2	M31184	3/8-16 HEX FLANGE NUT, SS
3	4	M31130	3/8 WASHER, SS
4	2	M30383	3/8-16 STRUT NUT, ZN
5	1	M40600	1 5/8 X 1 5/8 X 24 IN STRUT, GALV

UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

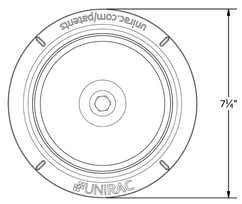
PRODUCT LINE:	RM10 EVO
DRAWING TYPE:	ASSEMBLY
DESCRIPTION:	RM10 ATTACHMENT KIT
REVISION DATE:	12/10/2021

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

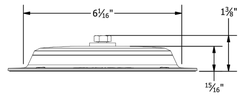
PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

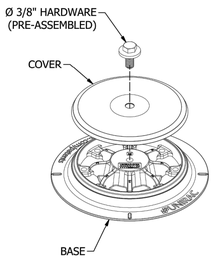
EVO-A09
SHEET

NOTES:
1. ATTACHMENT CAN ACCOMMODATE ROOFING SCREW SIZES #12 - #15. FASTENER SIZE, LENGTH, AND QUANTITY TO BE SELECTED BY STRUCTURAL ENGINEER OF RECORD WHEN DESIGNING FOR THE SPECIFIC PROJECT CONSTRUCTION AND CAPACITY.
2. REFER TO THE UNIRAC INSTALLATION GUIDE FOR PROPER USE OF CHEM LINK M1 AND ONE-PART SEALANTS FOR WATER TIGHT INSTALLATION.



TOP VIEW





PART # TABLE	
P/N	DESCRIPTION
310999	FLASHLOC RM KIT

ULTIMATE TEST LOAD (WITH 8 ROOF FASTENERS)

UPLIFT ULTIMATE CAPACITY	6,670 lbs.
SHEAR ULTIMATE CAPACITY	5,760 lbs.

UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

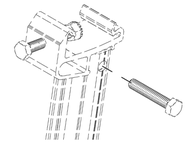
PRODUCT LINE:	RM10 EVO
DRAWING TYPE:	ASSEMBLY DETAIL
DESCRIPTION:	FLASHLOC RM KIT
REVISION DATE:	12/10/2021

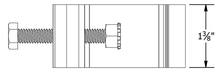
DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

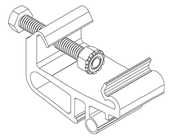
PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

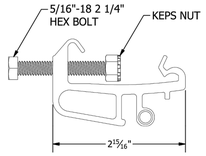
EVO-A10
SHEET

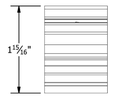
ASSEMBLY # TABLE	
P/N	DESCRIPTION
370020	RM10 EVO MODULE CLAMP KIT











UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

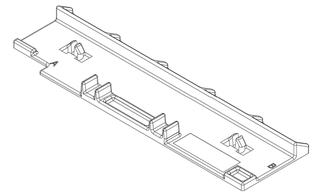
PRODUCT LINE:	RM10 EVO
DRAWING TYPE:	PARTS
DESCRIPTION:	MODULE CLIP PIN BOLT
REVISION DATE:	12/10/2021

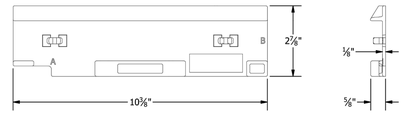
DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

EVO-A11
SHEET

PART # TABLE	
P/N	DESCRIPTION
310760	RM10 ROOF PAD





NOTES:
1. MATERIAL: TPE 70 SHORE A: SANTOPRENE 201-73, ELASTOCON 2870 OR UNISOFT TPE ST-70A BK-2-01.
2. FINISH: BLACK

UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	RM10 EVO
DRAWING TYPE:	PART
DESCRIPTION:	RM10 ROOF PAD
REVISION DATE:	12/10/2021

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

EVO-P01
SHEET

STATE OF MISSOURI
GERALD H. CRAFTON
NUMBER PE-2004020052
PROFESSIONAL ENGINEER
7/6/2022

Lee's Summit Detail Shop

EQUIPMENT DATA SHEET

94.05 KW DC Rooftop Photovoltaic System
2100 NE Independence Ave, Lee's Summit, MO 64064, USA

NAME OF CUSTOMER: | TITLE: | SUBJECT: | PROJECT LOCATION:

Rev #	DATE	REMARKS	DESIGNED	CHECKED	APPROVED
1	05-27-2022	Lee's Summit Detail Shop - Rev 1			

Artisun Solar
12916 6TH ST
GRANDVIEW, MO 64030
PH: (913) 601-0700

DWG NO: D-3

PROJ NO: NEI-210

UNIRAC

U-BUILDER PROJECT REPORT

VERSION: 3.1.6

PROJECT TITLE	PROJECT ID	CREATED
RM10 EVO	EEF91FF4	April 22, 2022, 10:17 a.m.

NAME	Lee's Summit Detail Shop
ADDRESS	2100 NE Independence Ave
CITY, STATE	Lees Summit, MO
MODULE	Znshinesolar ZXM6-NH144 -450

Designed by kirk@artisunsolar.com

RM10 EVO

Znshinesolar

209 - ZXM6-NH144 -450

4889.00 ft^2

94.05 KW

BILL OF MATERIALS

LEGEND: Base System Part Accessory

PART NUMBER	PART TYPE	DESCRIPTION	QUANTITY	SUGGESTED QUANTITY	UNIT PRICE (USD)	TOTAL LIST PRICE (USD)
User Supplied	Ballast Block	BALLAST BLOCK	447	447	0.00	0.00
370010	Ballast Bay	RM10 EVO FIELD BAY	247	247	44.76	11055.72
370011	Ballast Bay	RM10 EVO NORTH ROW BAY	60	60	44.76	2685.60
370020	Clamp	EVO MOD CLAMP KIT	972	972	3.94	3829.68
310760	RM Roof Pad	RM ROOF PAD	172	172	2.35	404.20

BASE SYSTEM PRICE	ACCESSORIES PRICE	TOTAL PRICE
$17571.00	$404.20	$17975.20
$0.187 PER WATT	$0.004 PER WATT	$0.191 PER WATT

This design is to be evaluated to the product appropriate Unirac Code Compliant Installation Manual which references International Building Code 2009, 2012, 2015, 2018 and ASCE 7-05, ASCE 7-10, ASCE 7-16 and California Building Code 2010, 2016. The installation of products related to this design is subject to requirements in the above mentioned installation manual.

DETAILED PARTS DESCRIPTION

QTY

Ballast Block UserSupplied BALLAST BLOCK

447

Standard 4x8x16 inch cap blocks. Nationwide availability. Please confirm the weight of your ballast block as this will affect the total blocks required for your installation.

Ballast Bay 370010 RM10 EVO FIELD BAY

247

Ballast Bay 370011 RM10 EVO NORTH ROW BAY

60

Clamp 370020 EVO MOD CLAMP KIT

972

RM Roof Pad 310760 RM ROOF PAD

172

ENGINEERING REPORT

Plan review

AVERAGE PSF	**3.81 psf**
TOTAL NUMBER OF MODULES	209
TOTAL KW	94.05 KW
TOTAL MODULE AREA	~6847 ft^2
TOTAL WEIGHT ON ROOF	26114 lbs
RACKING WEIGHT	752 lbs
MODULE WEIGHT	11058 lbs
BALLAST WEIGHT	14304 lbs
MAX BAY LOAD (DEAD)	119 lbs

Loads Used for Design

BUILDING CODE	ASCE 7-10
BASIC WIND SPEED	120.00 mph
GROUND SNOW LOAD	20.00 psf
SEISMIC (Ss)	0.110
ELEVATION	951.00 ft
WIND EXPOSURE	B
MRI	25
RISK CATEGORY	II
VELOCITY PRESSURE, QZ	18.94 psf

Loads Determined by Zip 64064

CITY, STATE	Lees Summit, MO
BASIC WIND SPEED	115.00 mph
GROUND SNOW LOAD	20.00 psf

Inspection

PRODUCT	RM10 EVO
MODULE MANUFACTURER	Znshinesolar
MODEL	ZXM6-NH144 -450
MODULE WATTS	450 watts
MODULE LENGTH	82.44"
MODULE WIDTH	40.86"
MODULE THICKNESS	1.38"
MODULE WEIGHT	52.91 lbs
BALLAST BLOCK (CMU) WEIGHT	32.0 lbs
MAX BLOCKS PER NORTH BAY	4
MAX BLOCKS PER NON NORTH BAY	3
BUILDING HEIGHT	30.00 ft
ROOF TYPE	TPO
PARAPET HEIGHT	72.00"
RISK CATEGORY	II

Roof Area 1 - Array 1

AVERAGE PSF	**3.50 psf**
TOTAL NUMBER OF MODULES:	66
TOTAL KW:	29.70 KW
TOTAL AREA:	2177 ft^2
TOTAL WEIGHT ON ROOF:	7626 lbs
RACKING WEIGHT:	230 lbs
MODULE WEIGHT:	3492 lbs
BALLAST WEIGHT:	3904 lbs

MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) *	
ARRAY TO ARRAY:	3.0"
TO FIXED OBJECT ON ROOF:	6.0"
TO ROOF EDGE WITH QUALIFYING PARAPET:	6.0"
TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	9.0"
MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *	
MAX NUMBER OF NORTH-SOUTH ROWS:	20
MAX NUMBER OF EAST-WEST COLUMNS:	33

*In jurisdictions that follow SEAOC PV-1 methodology.

Roof Area 1 - Array 2

AVERAGE PSF	**3.68 psf**
TOTAL NUMBER OF MODULES:	85
TOTAL KW:	38.25 KW
TOTAL AREA:	2770 ft^2
TOTAL WEIGHT ON ROOF:	10197 lbs
RACKING WEIGHT:	292 lbs
MODULE WEIGHT:	4497 lbs
BALLAST WEIGHT:	5408 lbs

MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) *	
ARRAY TO ARRAY:	3.0"
TO FIXED OBJECT ON ROOF:	6.0"
TO ROOF EDGE WITH QUALIFYING PARAPET:	6.0"
TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	9.0"
MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *	
MAX NUMBER OF NORTH-SOUTH ROWS:	19
MAX NUMBER OF EAST-WEST COLUMNS:	32

*In jurisdictions that follow SEAOC PV-1 methodology.

Roof Area 1 - Array 3

AVERAGE PSF	**4.52 psf**
TOTAL NUMBER OF MODULES:	12
TOTAL KW:	5.40 KW
TOTAL AREA:	392 ft^2
TOTAL WEIGHT ON ROOF:	1772 lbs
RACKING WEIGHT:	49 lbs
MODULE WEIGHT:	635 lbs
BALLAST WEIGHT:	1088 lbs

MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) *	
ARRAY TO ARRAY:	3.0"
TO FIXED OBJECT ON ROOF:	6.0"
TO ROOF EDGE WITH QUALIFYING PARAPET:	6.0"
TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	9.0"
MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *	
MAX NUMBER OF NORTH-SOUTH ROWS:	16
MAX NUMBER OF EAST-WEST COLUMNS:	26

*In jurisdictions that follow SEAOC PV-1 methodology.

Roof Area 1 - Array 4

AVERAGE PSF	**4.40 psf**
TOTAL NUMBER OF MODULES:	15
TOTAL KW:	6.75 KW
TOTAL AREA:	485 ft^2
TOTAL WEIGHT ON ROOF:	2135 lbs
RACKING WEIGHT:	61 lbs
MODULE WEIGHT:	794 lbs
BALLAST WEIGHT:	1280 lbs

MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) *	
ARRAY TO ARRAY:	3.0"
TO FIXED OBJECT ON ROOF:	6.0"
TO ROOF EDGE WITH QUALIFYING PARAPET:	6.0"
TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	9.0"
MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *	
MAX NUMBER OF NORTH-SOUTH ROWS:	16
MAX NUMBER OF EAST-WEST COLUMNS:	27

*In jurisdictions that follow SEAOC PV-1 methodology.

Roof Area 1 - Array 5

AVERAGE PSF	**4.14 psf**
TOTAL NUMBER OF MODULES:	19
TOTAL KW:	8.55 KW
TOTAL AREA:	623 ft^2
TOTAL WEIGHT ON ROOF:	2580 lbs
RACKING WEIGHT:	71 lbs
MODULE WEIGHT:	1005 lbs
BALLAST WEIGHT:	1504 lbs

MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) *	
ARRAY TO ARRAY:	3.0"
TO FIXED OBJECT ON ROOF:	6.0"
TO ROOF EDGE WITH QUALIFYING PARAPET:	6.0"
TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	9.0"
MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *	
MAX NUMBER OF NORTH-SOUTH ROWS:	17
MAX NUMBER OF EAST-WEST COLUMNS:	28

*In jurisdictions that follow SEAOC PV-1 methodology.

Roof Area 1 - Array 6

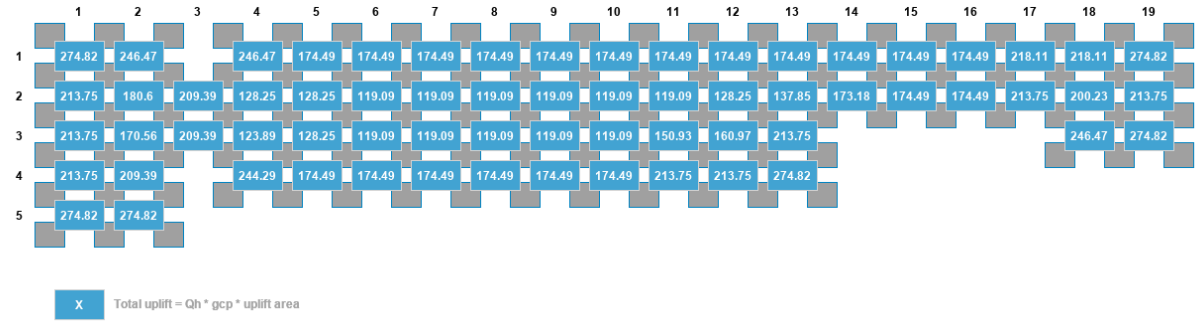
AVERAGE PSF	**4.51 psf**
TOTAL NUMBER OF MODULES:	12
TOTAL KW:	5.40 KW
TOTAL AREA:	400 ft^2
TOTAL WEIGHT ON ROOF:	1804 lbs
RACKING WEIGHT:	49 lbs
MODULE WEIGHT:	635 lbs
BALLAST WEIGHT:	1120 lbs

MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) *	
ARRAY TO ARRAY:	3.0"
TO FIXED OBJECT ON ROOF:	6.0"
TO ROOF EDGE WITH QUALIFYING PARAPET:	6.0"
TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	9.0"
MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *	
MAX NUMBER OF NORTH-SOUTH ROWS:	15
MAX NUMBER OF EAST-WEST COLUMNS:	25

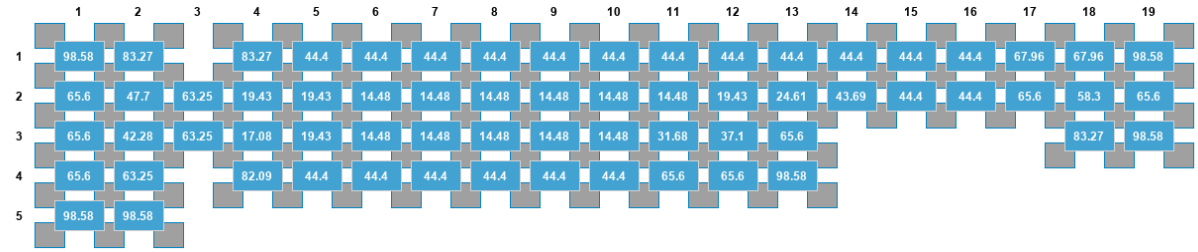
*In jurisdictions that follow SEAOC PV-1 methodology.

Uplift Calculation per Bay with North bay factor: - Roof Area 1 - Array 1

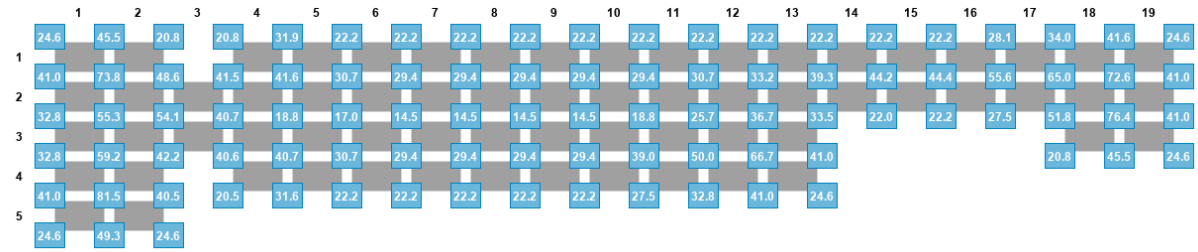
Total uplift weight per module



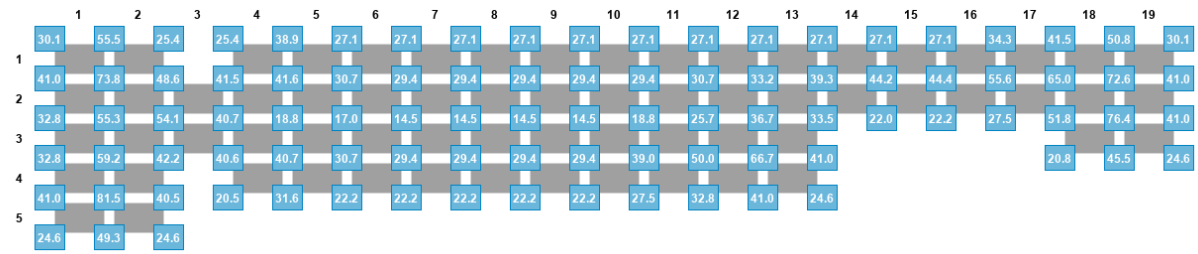
Net uplift weight per module



Uplift weight per Bay

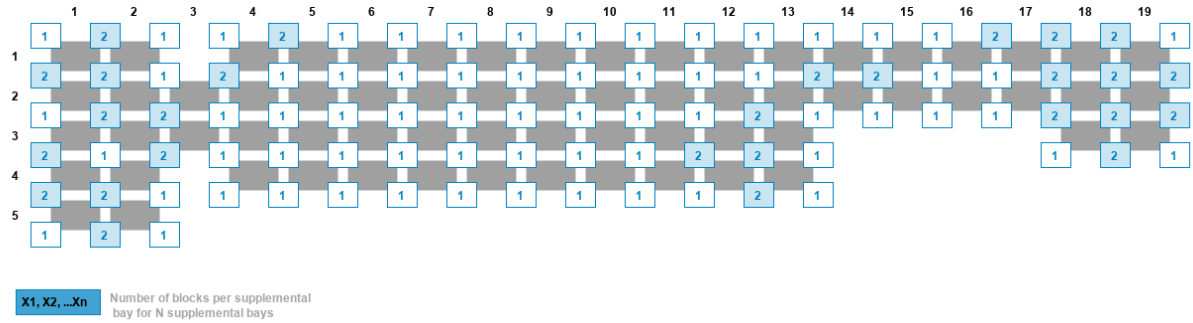


Uplift weight with North bay factor



Note : Bays map with 1.22 factor is displayed in "North bay factor Map" in Engineering layouts

Blocks per bay

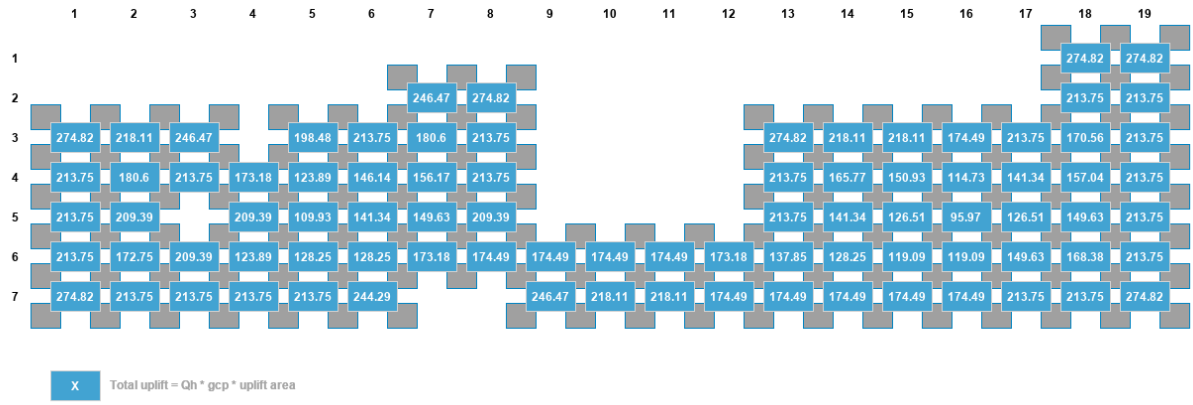


X1, X2, ...Xn — Number of blocks per supplemental bay for N supplemental bays

Note : Any additional blocks added in the layout contribute to sliding

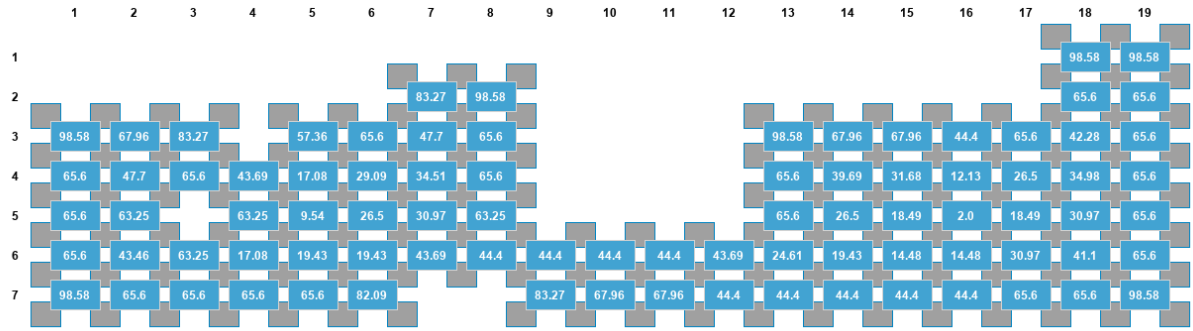
Uplift Calculation per Bay with North bay factor: - Roof Area 1 - Array 2

Total uplift weight per module

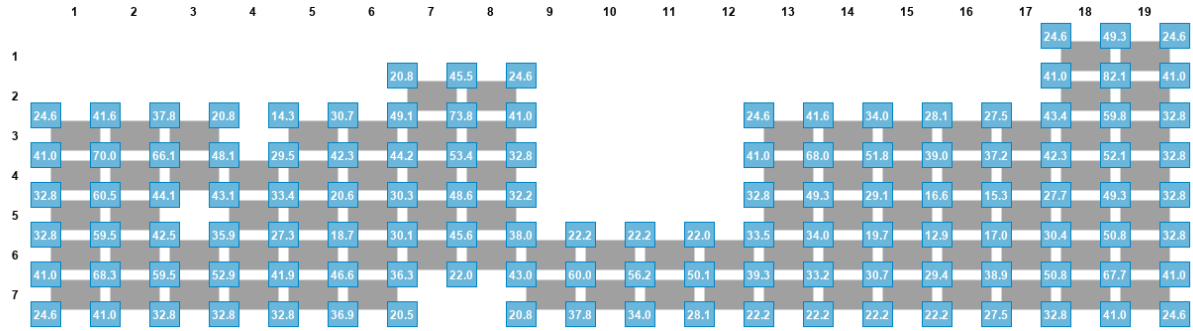


X — Total uplift = Qh * gcp * uplift area

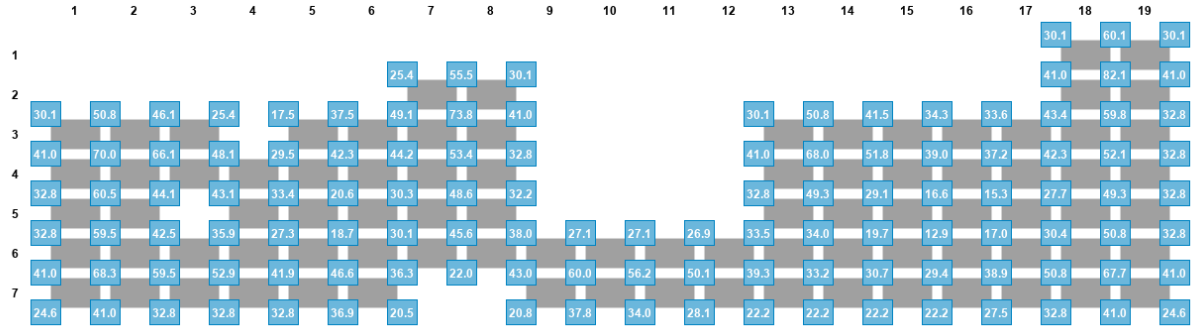
Net uplift weight per module



Uplift weight per Bay

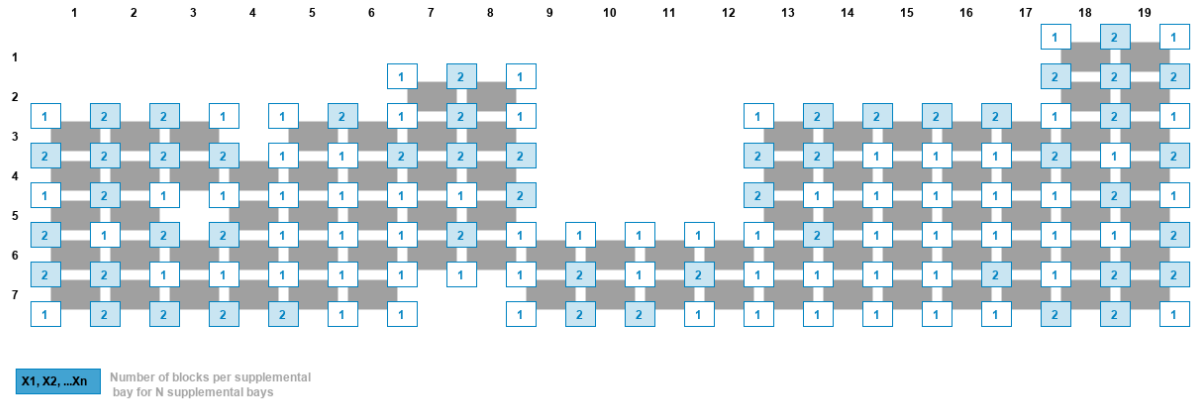


Uplift weight with North bay factor



Note : Bays map with 1.22 factor is displayed in "North bay factor Map" in Engineering layouts

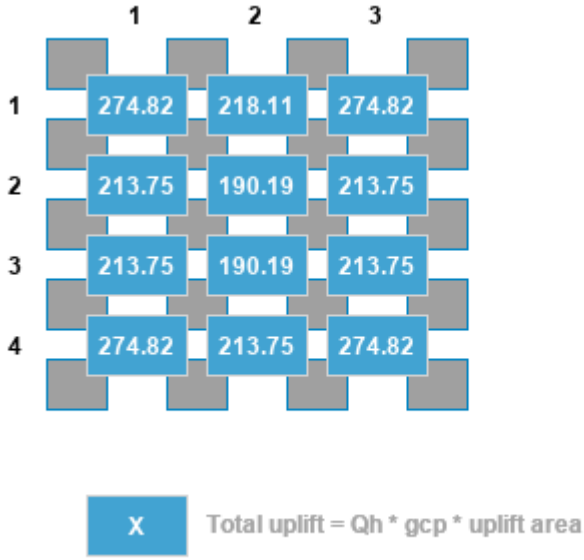
Blocks per bay



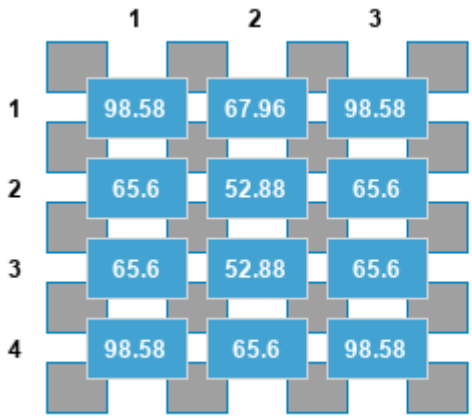
Note : Any additional blocks added in the layout contribute to sliding

Uplift Calculation per Bay with North bay factor: - Roof Area 1 - Array 3

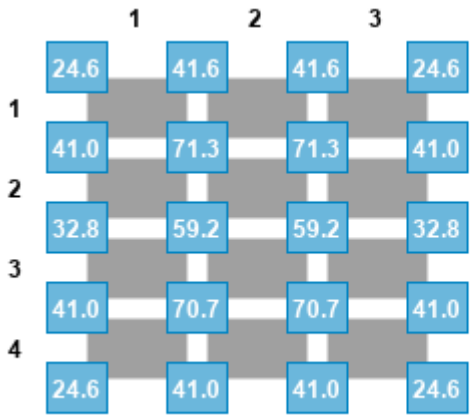
Total uplift weight per module



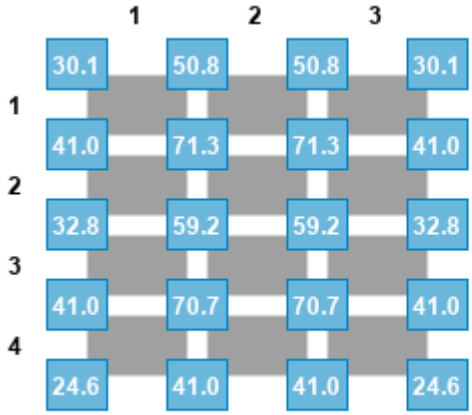
Net uplift weight per module



Uplift weight per Bay

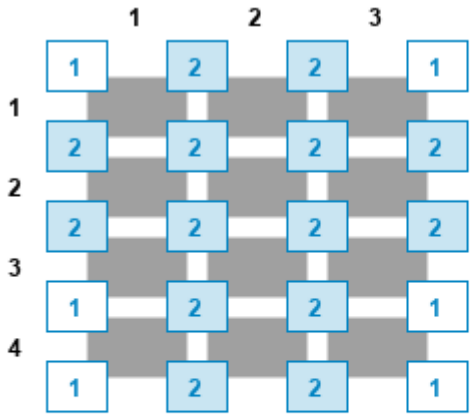


Uplift weight with North bay factor



Note : Bays map with 1.22 factor is displayed in "North bay factor Map" in Engineering layouts

Blocks per bay

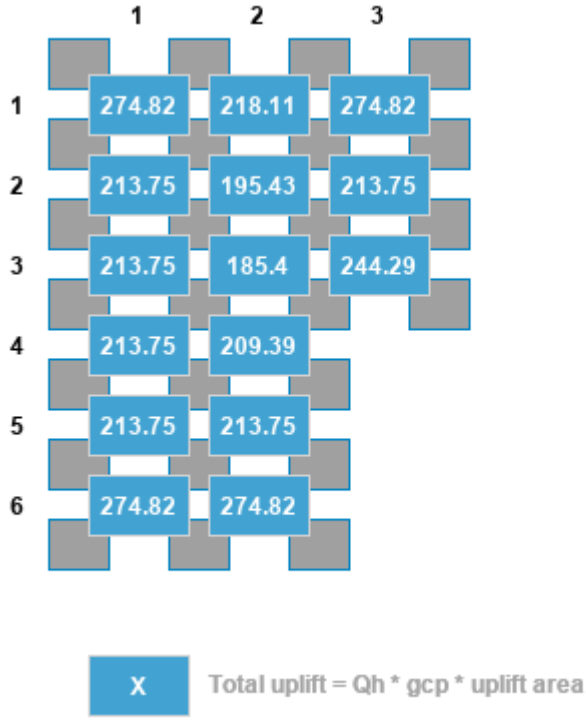


X1, X2, ...Xn — Number of blocks per supplemental bay for N supplemental bays

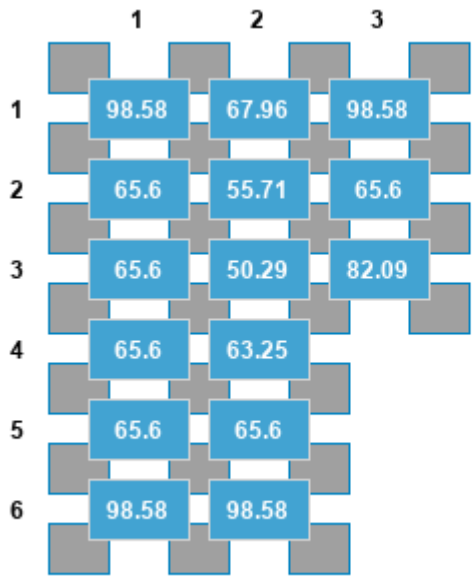
Note : Any additional blocks added in the layout contribute to sliding

Uplift Calculation per Bay with North bay factor: - Roof Area 1 - Array 4

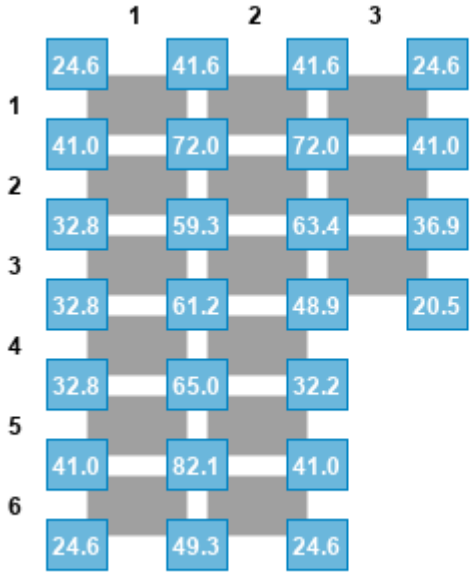
Total uplift weight per module



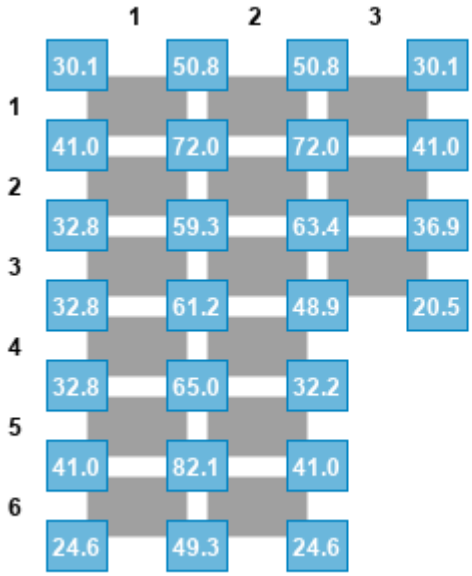
Net uplift weight per module



Uplift weight per Bay

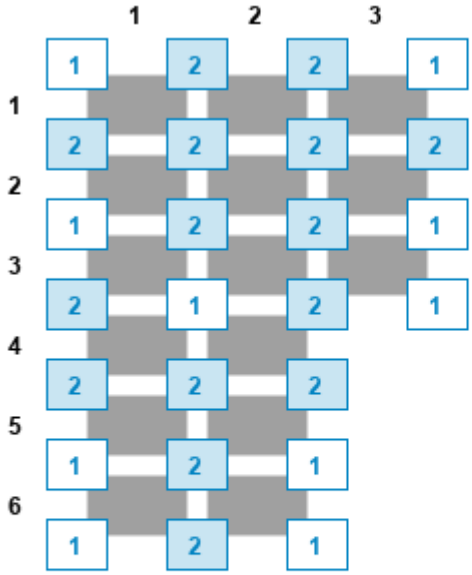


Uplift weight with North bay factor



Note : Bays map with 1.22 factor is displayed in "North bay factor Map" in Engineering layouts

Blocks per bay

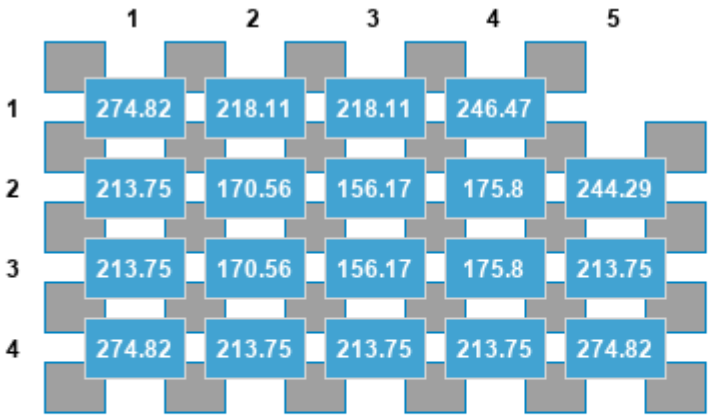


X1, X2, ...Xn — Number of blocks per supplemental bay for N supplemental bays

Note : Any additional blocks added in the layout contribute to sliding

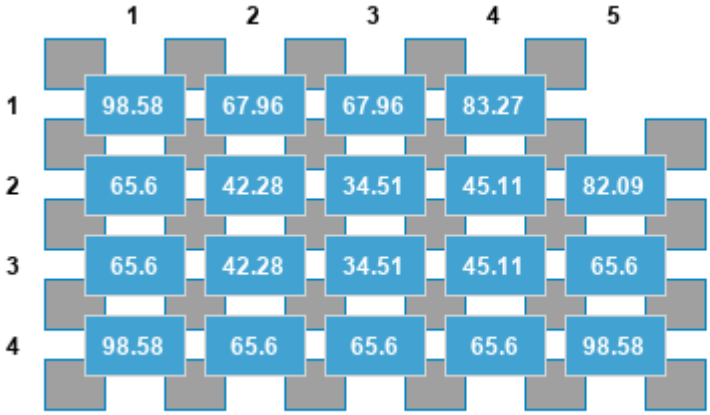
Uplift Calculation per Bay with North bay factor: - Roof Area 1 - Array 5

Total uplift weight per module

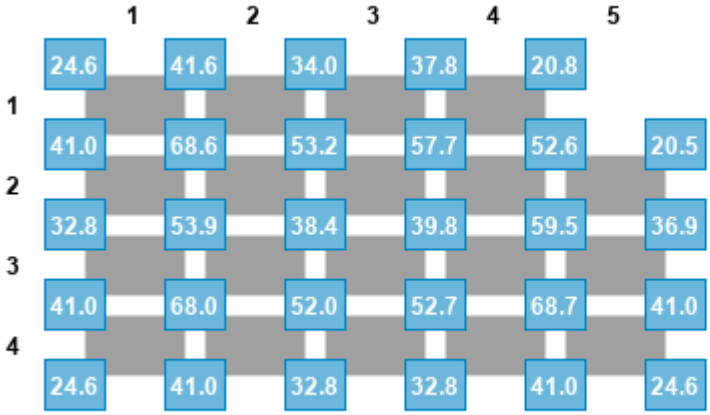


X — Total uplift = Qh * gcp * uplift area

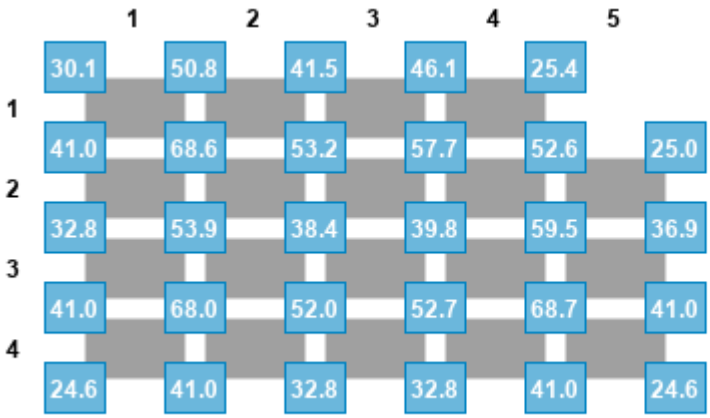
Net uplift weight per module



Uplift weight per Bay

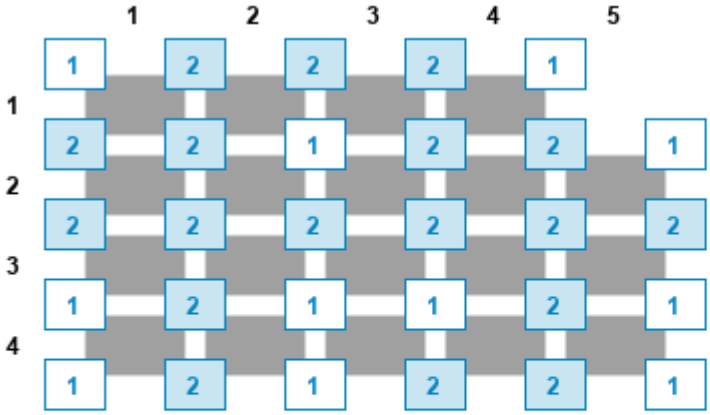


Uplift weight with North bay factor



Note : Bays map with 1.22 factor is displayed in "North bay factor Map" in Engineering layouts

Blocks per bay

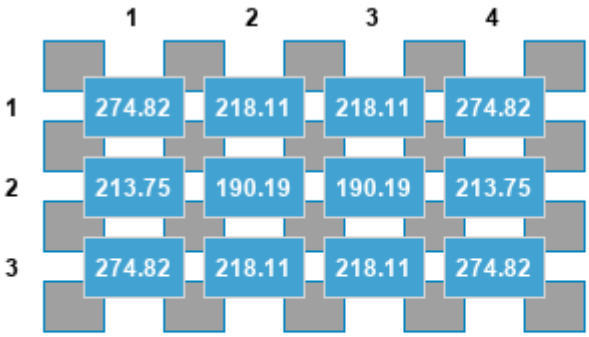


X1, X2, ...Xn — Number of blocks per supplemental bay for N supplemental bays

Note : Any additional blocks added in the layout contribute to sliding

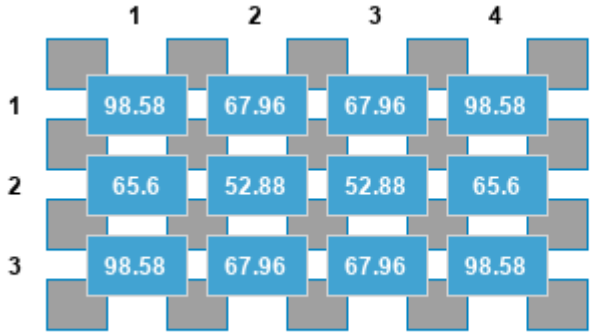
Uplift Calculation per Bay with North bay factor: - Roof Area 1 - Array 6

Total uplift weight per module

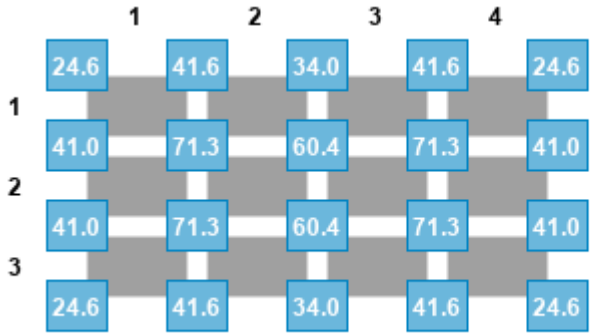


X — Total uplift = Qh * gcp * uplift area

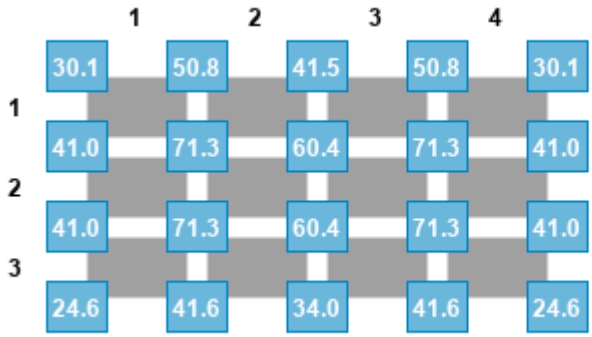
Net uplift weight per module



Uplift weight per Bay

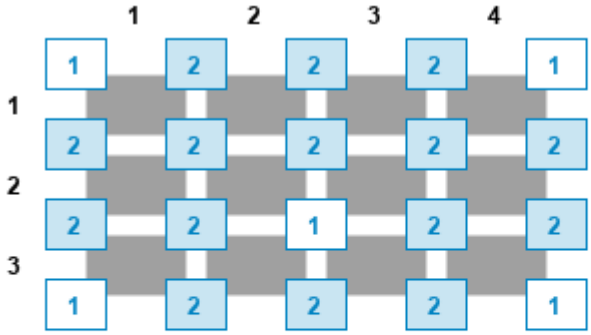


Uplift weight with North bay factor



Note : Bays map with 1.22 factor is displayed in "North bay factor Map" in Engineering layouts

Blocks per bay



X1, X2, ...Xn — Number of blocks per supplemental bay for N supplemental bays

Note : Any additional blocks added in the layout contribute to sliding

RM10 EVO U-BUILDER PRODUCT ASSUMPTIONS

RM10 EVO– Ballasted Flat Roof Systems

Limitations of Responsibility: It is the user's responsibility to ensure that inputs are correct for your specific project.
Unirac is not the solar, electrical, or building engineer of record and is not responsible for the solar, electrical, or building design for this project.

Building Assumptions

1. Building Height ≤ 50 ft
2. Building Height > 50 ft: only where (longest length of building x building height)^0.5 ≤ 100 ft
3. Roof Slope ≥ 0° (0:12) and ≤ 3° (5/8:12) for Seismic Design Category C, D, E and F. For low seismic regions Seismic Design Category A and B (provided Array Importance factor = 1.0), Roof Slope ≥ 0° (0:12) and ≤ 7° (1 1/2:12).
4. Roofing Material Types: EDPM, PVC, TPO, or Mineral Cap
5. Surrounding Building Grade: Level

Ballast Blocks

The installer is responsible for procuring the ballast blocks (Concrete Masonry Units – CMU) and verifying the required minimum weight needed for this design. CMU should comply with ASM standard specification for concrete roof pavers designation (C1491 or C90 with an integral water repellent suitable for the climate it is placed. It is recommended that the blocks are inspected periodically for any signs of degradation. If degradation of the block is observed, the block should immediately be replaced.
The CMU ballast block should have nominal dimensions of 4"x8"x16". The actual block dimensions are 3/8" less than the nominal dimensions. Ballast blocks should have a weight as specified for the project in the "Inspection" section of this report.

Design Parameters

1. Risk Category I to III
2. Wind Design
    a. Basic Wind Speed:110-150 mph (ASCE 7-10)/90-180 mph (ASCE 7-16)
    b. Exposure: B, C or D (ASCE 7-10/ASCE 7-16)
    c. 25 year or 50 year Design Life for ASCE 7-10 /50 year Design Life for ASCE 7-16
    d. Elevation: Insertion of the project at - grade elevation can result in a reduction of wind pressure. If your project is in a special case study region or in an area where wind studies have been performed, please verify with your jurisdiction to ensure that elevation effects have not already been factored into the wind speed. If elevation effects have been included in your wind speed, please select 0 ft as the project site elevation.
    e. Wind Tunnel Testing: Wind tunnel testing coefficients have been utilized for design of the system.
3. Snow Design
    a. Ground Snow Load: 0-100 psf (ASCE 7-10/ASCE 7-16)
    b. Exposure Factor: 0.9
    c. Thermal Factor: 1.2
    d. Roof Snow Load: Calculation per Section 7.3 (ASCE 7-10/ASCE 7-16)
    e. Unbalanced/Drifting/Sliding: Results are based on the uniform snow loading and do not consider unbalanced, drifting, and sliding conditions
4. Seismic Design
    a. Report *SEAOC PV1-2012/ASCE 7-16 SECTION 13.6.12 – Structural Seismic Requirements and Commentary for Rooftop Solar Photovoltaic Arrays*
    b. Importance Factor Array (Ip): 1.0
    c. Importance Factor Building (Ie): 1.0
    d. Site Class: D

Properties

1. Bay Weight: ~2.45 lbs
2. Module Gaps (E/W) = 0.25 in
3. Module Gaps (N/S) = 13.5 in

Testing

1. Coefficient of Friction
2. Wind Tunnel
3. UL 2703
4. Component Testing (Bay and Clamp)

Setbacks

For the wind tunnel recommendations in U-Builder to apply, the following setbacks should be observed/followed for U-Builder wind design:

1. Modules should be placed a minimum of 3 feet from the edge of the building in any direction.
2. If the array is located near an obstruction that is 3.5 feet wide and 3.5 feet high or larger, the nearest module of the array must be located a distance from the obstruction that is greater than or equal to the height of the obstruction. Exception: When using ASCE 7-16 Building Code and using the obstruction feature in the module editor to accurately model the size and location of obstruction.
3. Installations within the setbacks listed above require site specific engineering[2]
4. The setbacks above are for wind. High seismic areas, fire access isles, mechanical equipment, etc., may require larger setbacks than listed above for wind.

Site Specific Engineering

Conditions listed below are beyond the current capabilities of U-Builder. Site specific engineering is required.

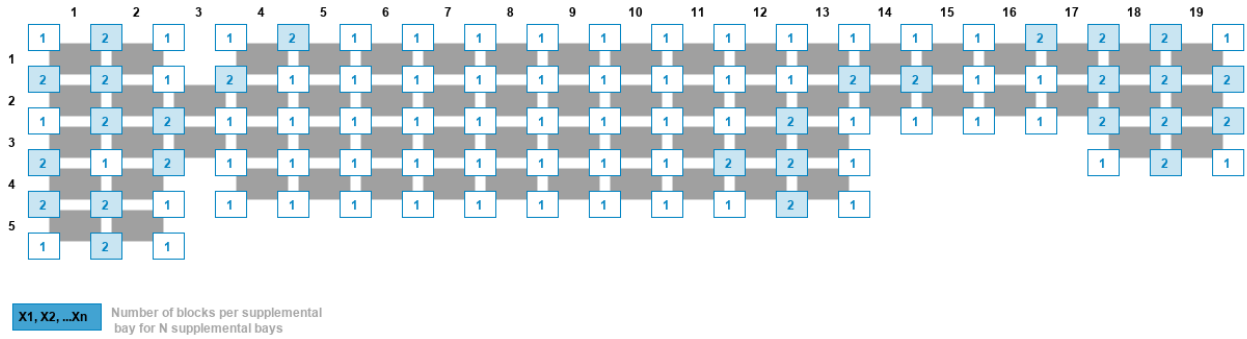
1. Wind designs for a project design life exceeding 25 years[1]/ASCE 7-16
2. Building assumptions and design parameters outside of U-Builder assumptions[2]
3. Attachments[2]
4. Risk Category III or IV projects (U-Builder can be adjusted for the correct wind, but not the seismic or snow design)[2]
5. Wind tunnel testing reduction factors are not permitted by the Authority Having Jurisdiction (AHJ)[3]
6. Seismic designs that fall outside SEAOC PV1-2012/ASCE 7-16 SECTION 13.6.12 recommendations (>3% roof slope, or AHJ's that require shake table testing or non-linear site-specific response history analysis)[3]
7. Signed and sealed site-specific calculations, layouts, and drawings[3]

Notes:

[1]Please contact info@unirac.com.
[2] Please contact EngineeringServices@unirac.com for more information.
[3]Please contact Theresa Allen with PZSE Structural Engineers at theresa@pzse.com. These items will require direct coordination with PZSE to complete the requested services.

INSTALLATION AND DESIGN PLAN

Roof Area 1 / Roof Area 1 - Array 1



NOTE

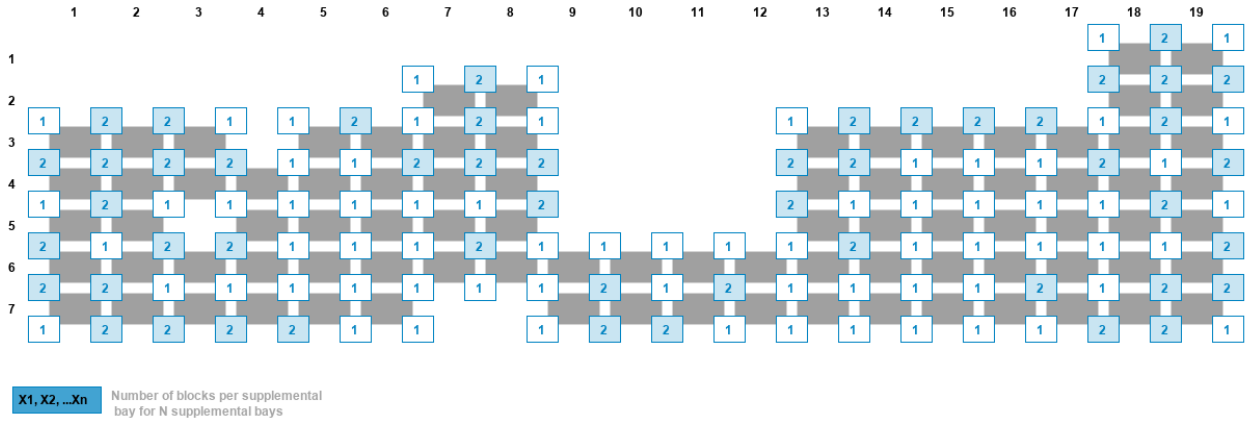
Install two roof pads to every other primary bay in a row of bays, then skip a row, and do it again.

Layout Dimensions

NS DIMENSION	~ 24.35 ft
EW DIMENSION	~ 130.53 ft

ROW	MODULES	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	18	20	25	800
2	19	20	28	896
3	15	20	26	832
4	12	17	22	704
5	2	14	17	544
6	0	3	4	128

Roof Area 1 / Roof Area 1 - Array 2



NOTE

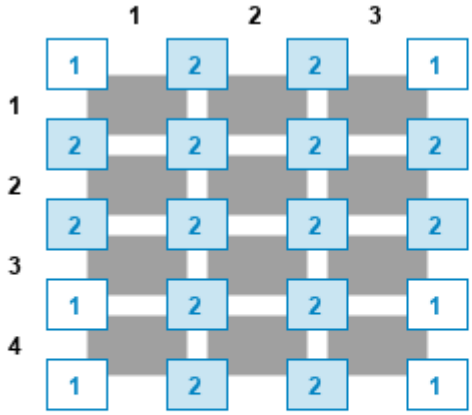
Install two roof pads to every other primary bay in a row of bays, then skip a row, and do it again.

Layout Dimensions

NS DIMENSION	~ 33.31 ft
EW DIMENSION	~ 130.53 ft

ROW	MODULES	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	2	3	4	128
2	4	6	10	320
3	14	17	26	832
4	15	17	28	896
5	14	17	21	672
6	19	20	26	832
7	17	20	27	864
8	0	19	27	864

Roof Area 1 / Roof Area 1 - Array 3



NOTE

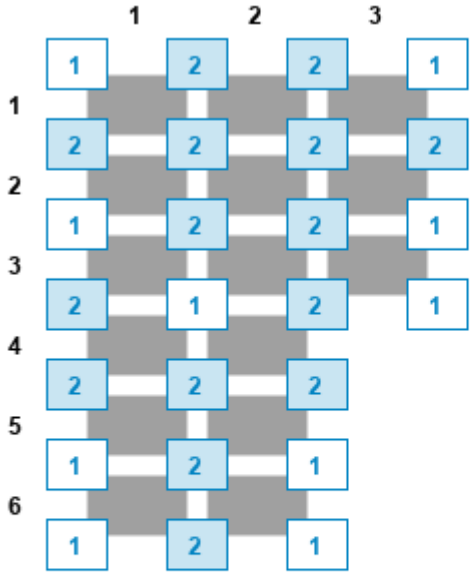
Install two roof pads to every other primary bay in a row of bays, then skip a row, and do it again.

Layout Dimensions

NS DIMENSION	~ 19.87 ft
EW DIMENSION	~ 20.61 ft

ROW	MODULES	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	3	4	6	192
2	3	4	8	256
3	3	4	8	256
4	3	4	6	192
5	0	4	6	192

Roof Area 1 / Roof Area 1 - Array 4



NOTE

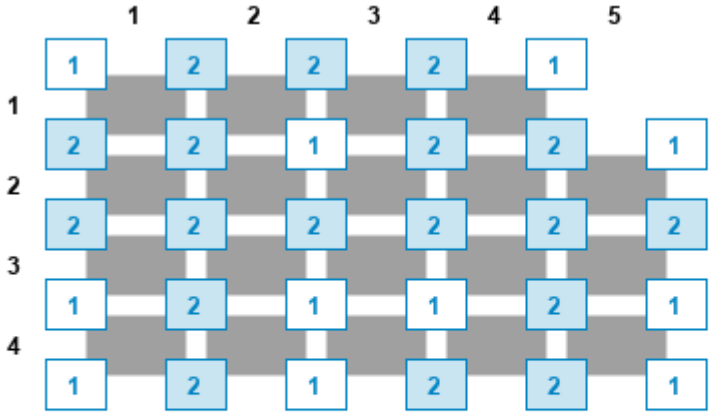
Install two roof pads to every other primary bay in a row of bays, then skip a row, and do it again.

Layout Dimensions

NS DIMENSION	~ 28.83 ft
EW DIMENSION	~ 20.61 ft

ROW	MODULES	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	3	4	6	192
2	3	4	8	256
3	3	4	6	192
4	2	4	6	192
5	2	3	6	192
6	2	3	4	128
7	0	3	4	128

Roof Area 1 / Roof Area 1 - Array 5



X1, X2, ...Xn — Number of blocks per supplemental bay for N supplemental bays

NOTE

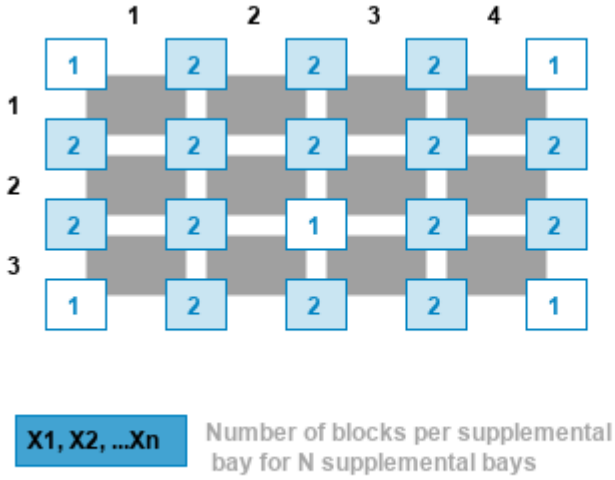
Install two roof pads to every other primary bay in a row of bays, then skip a row, and do it again.

Layout Dimensions

NS DIMENSION	~ 19.87 ft
EW DIMENSION	~ 34.35 ft

ROW	MODULES	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	4	5	8	256
2	5	6	10	320
3	5	6	12	384
4	5	6	8	256
5	0	6	9	288

Roof Area 1 / Roof Area 1 - Array 6



NOTE

Install two roof pads to every other primary bay in a row of bays, then skip a row, and do it again.

Layout Dimensions

NS DIMENSION	~ 15.39 ft
EW DIMENSION	~ 27.48 ft

ROW	MODULES	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	4	5	8	256
2	4	5	10	320
3	4	5	9	288
4	0	5	8	256