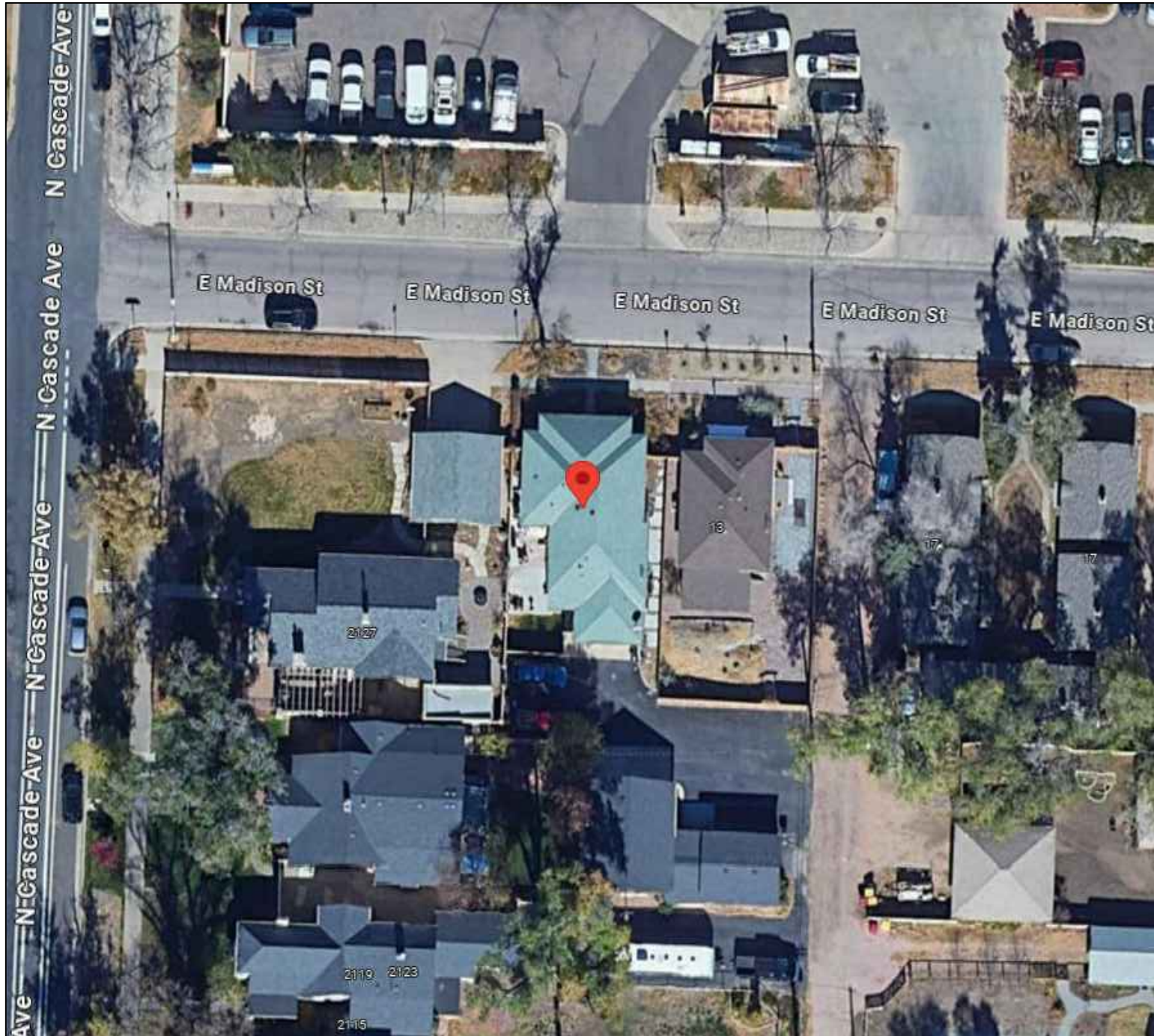


AERIAL SITE VIEW



SCOPE OF WORK

INSTALLATION OF UTILITY INTERACTIVE PHOTOVOLTAIC SOLAR SYSTEM

4.2 kW DC & 2.9 kW AC PHOTOVOLTAIC SOLAR ARRAY

PV MODULES: (10) SILFAB SOLAR SIL-420 HC+

INVERTER(S): (10) ENPHASE IQ8PLUS-72-2-US

ROOF TYPE: COMPOSITION SHINGLE - 1 LAYER(S)

PV MOUNTING HARDWARE: ECOFASTEN CLICKFIT STANDARD

SHEET LIST

G-1	COVER SHEET
V-2	SITE PLAN (AD. LIB)
S-3	ROOF PLAN
S-4	STRUCTURAL DETAILS
S-5	STRUCTURAL CALCULATIONS & NOTES
E-6	ELECTRICAL DETAILS (LINE DIAGRAM)
E-7	ELECTRICAL CALCULATIONS & NOTES
E-9	ELECTRICAL LABELS & LOCATIONS

JURISDICTION CODES AND STANDARDS

GOVERNING CODES

1. ALL WORK SHALL COMPLY WITH:
- 2020 NATIONAL ELECTRIC CODE (NEC)
 - 2021 INTERNATIONAL BUILDING CODE (IBC)
 - 2021 INTERNATIONAL RESIDENTIAL CODE (IRC)
 - 2021 INTERNATIONAL FIRE CODE (IFC)
- 2021 INTERNATIONAL ENERGY CONSERVATION CODE (IECC), 2021 INTERNATIONAL EXISTING BUILDING CODE (IEBC)
- AND ALL STATE AND LOCAL BUILDING, ELECTRICAL, AND PLUMBING CODES.

SITE CLASSIFICATION NOTES, OSHA REGULATION

- OCCUPANCY CLASS: SFR
- CONSTRUCTION CLASS: V-B
- ZONING TYPE: RESIDENTIAL
1. A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
 2. MODULES HAVE AN ANTI-REFLECTIVE COATING TO PREVENT GLARE
 3. JUNCTION BOXES UNDER PV ARRAY SHALL BE INSTALLED TO BE CONSIDERED ACCESSIBLE BY NEC 690.34

ELECTRICAL CRITERIA, NOTES

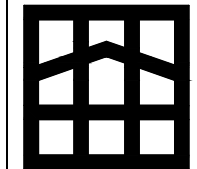
- TEMPERATURE SOURCE: ASHRAE
- WEATHER STATION: COLORADO SPRINGS MUNI AP
- EXTREME MIN. TEMPERATURE: -23
- ASHRAE 2% HIGH TEMP: 32
1. DRAWINGS HAVE BEEN DETAILED ACCORDING TO UL LISTING REQUIREMENTS.
 2. TERMINALS AND LUGS WILL BE TIGHTENED TO MANUFACTURER TORQUE SPECIFICATIONS (WHEN PROVIDED) IN ACCORDANCE WITH NEC 110.14(D) ON ALL ELECTRICAL.
 3. PV MODULE CERTIFICATIONS WILL INCLUDE ULI703, IEC61646, IEC61730.
 4. CONDUIT AND WIRE SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS.
 5. PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL BE PROVIDED AS PER SECTION [NEC 110.26].
 6. WHERE PV CABLES ON ROOFTOP WOULD OTHERWISE BE EXPOSED TO PHYSICAL DAMAGE, 3/4" EMT SHALL BE USED TO PROTECT CABLES
 6. SOLAR INSTALLATION SHALL COMPLY WITH NEC 334.10 AND NEC 334.12 AS APPLICABLE

STRUCTURAL CRITERIA, NOTES

- DESIGN LOAD STANDARD: ASCE 7-16
- WIND EXPOSURE CATEGORY: C
- WIND SPEED (3-SEC GUST): 130 MPH
- GROUND SNOW LOAD: 43 PSF
- DESIGN ROOF SNOW LOAD: 30 PSF
- SEISMIC DESIGN CATEGORY: B
- SEISMIC RISK FACTOR: II



ION DEVELOPER LLC
DAVID STANLEY CONRAD
EC
EC.0100960



ION SOLAR
44 E 800 N
OREM, UTAH 84057
888.781.7074

PROJECT ID
00CFQV

SITE OWNER
BRIAN REICHEL

SITE ADDRESS
11 EAST MADISON STREET
COLORADO SPRINGS, COLORADO 80907

EQUIP. (10) SILFAB SOLAR SIL-420 HC+
(10) ENPHASE IQ8PLUS-72-2-US

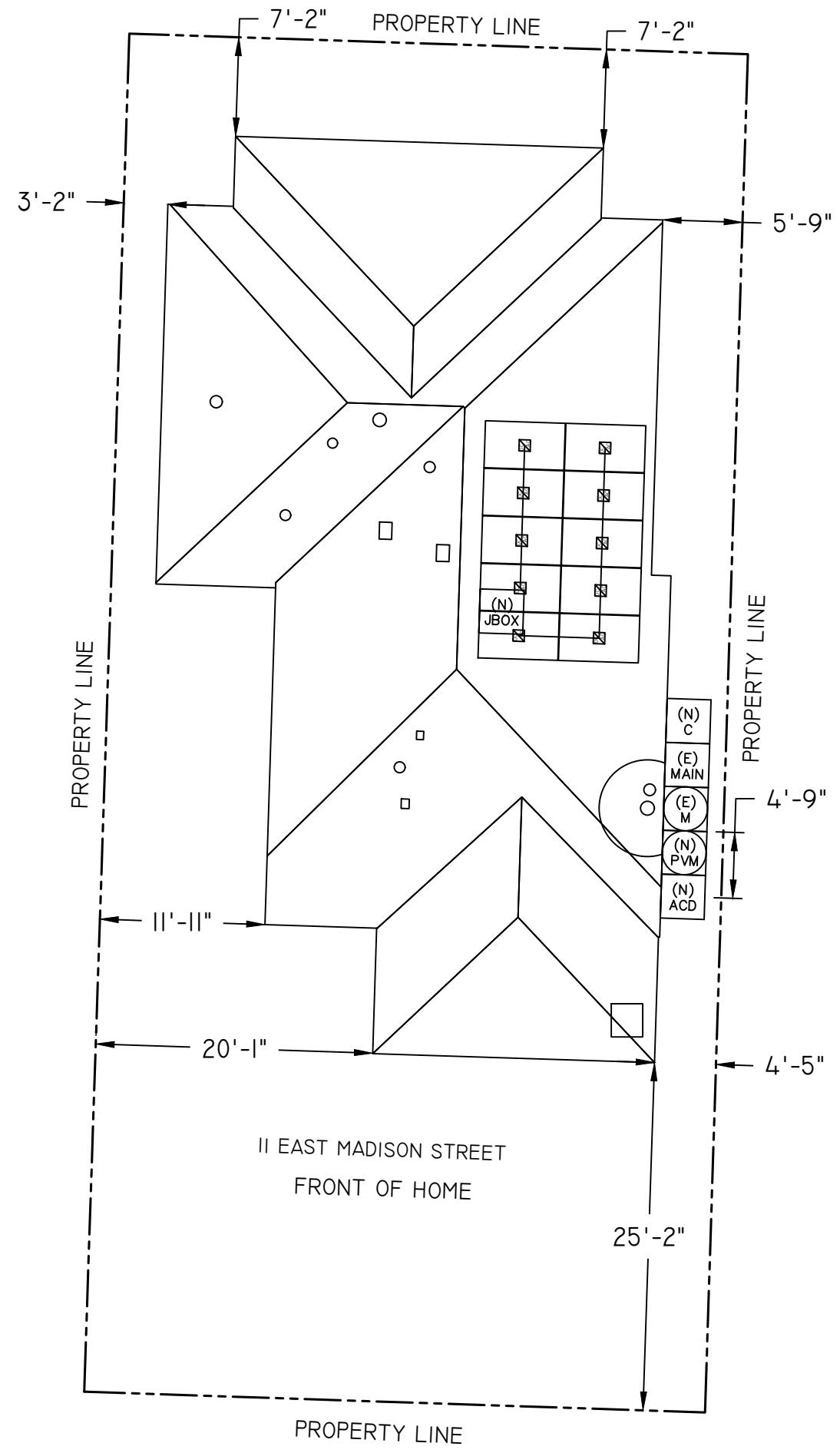
SYSTEM SIZE
4.2KW DC
2.9KW STC-AC, 3.748KW CEC-AC

PROJECT DESIGNER
CESAR CULLADOS

DATE
05-APR-2024

SHEET NAME
COVER SHEET

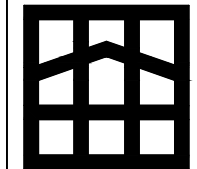
SHEET #	REV
G-1	0



SCALE: 3/32" = 1'-0"



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SITE OWNER
 BRIAN REICHEL

SITE ADDRESS
 11 EAST MADISON STREET
 COLORADO SPRINGS, COLORADO 80907

EQUIP.
 (10) SILFAB SOLAR SIL-420 HC+
 (10) ENPHASE IQ8PLUS-72-2-US

SYSTEM SIZE
 4.2KW DC
 2.9KW STC-AC, 3.748KW CEC-AC

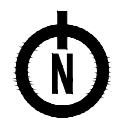
PROJECT DESIGNER
 CESAR CULLADOS

DATE
 05-APR-2024

SHEET NAME
 SITE PLAN

SHEET #
 V-2

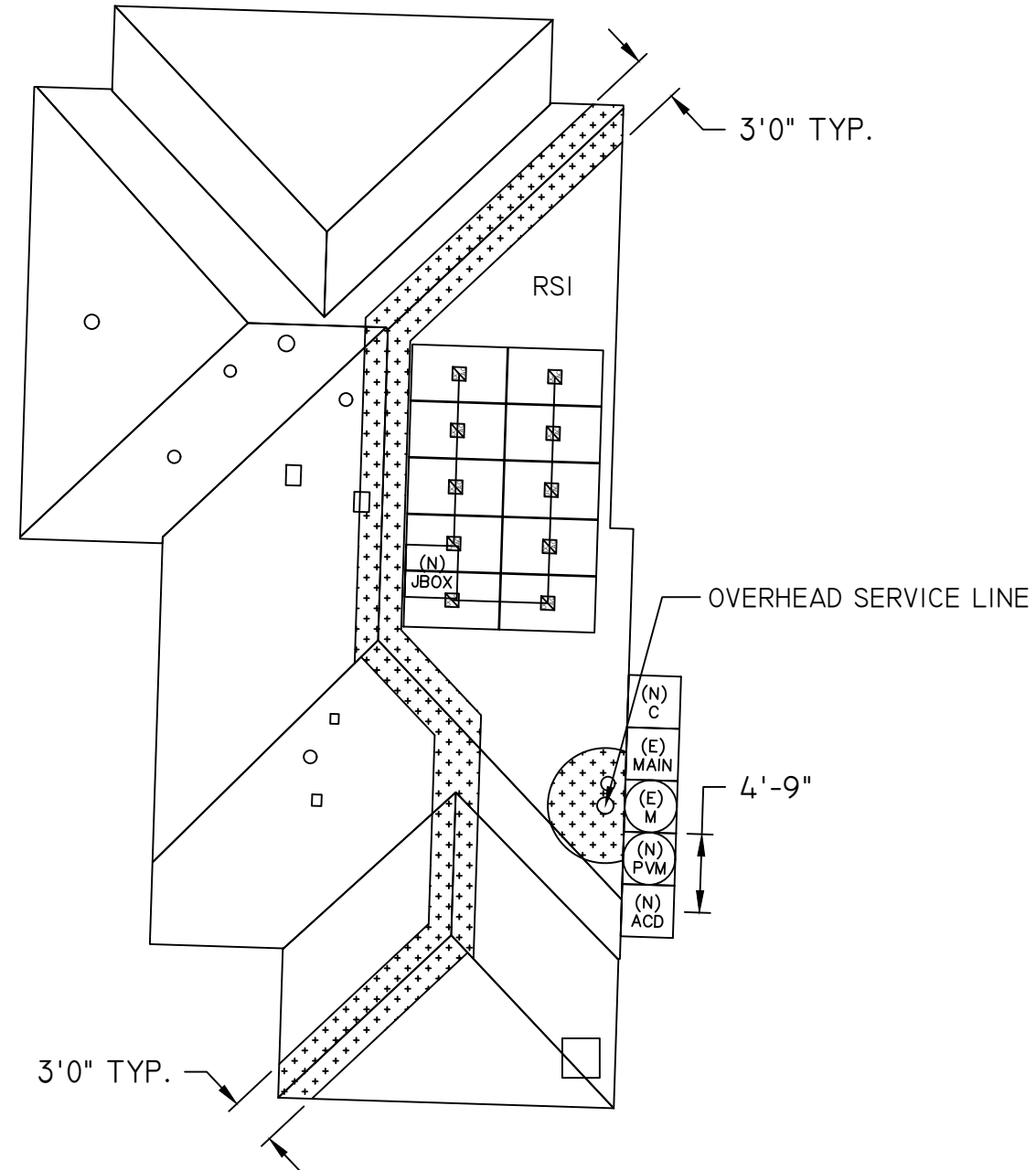
REV
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SITE NOTES:

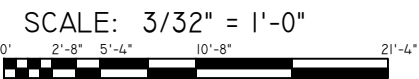
JUNCTION BOXES UNDER PV ARRAY SHALL BE INSTALLED TO BE CONSIDERED ACCESSIBLE BY NEC 690.34

II EAST MADISON STREET
FRONT OF HOME



ARRAY PARAMETERS

TOTAL ROOF AREA (SQ. FT.)	2180
TOTAL PV MODULE AREA (SQ. FT.)	213
% PV MODULE ROOF COVERAGE	9.77%



SYSTEM LEGEND

(E) UTILITY METER / MAIN SERVICE PANEL	(N) PV COMBINER PANEL	(N) JUNCTION BOX	S# SUNEYE LOCATION
(E) MAIN SERVICE PANEL	(N) PV LOAD CENTER	(N) AC DISCONNECT (VISIBLE-OPEN LOCKABLE LABELED DISCONNECT)	FIRE SETBACK
(E) SUBPANEL	(N) PV PRODUCTION METER	(N) MICROINVERTER	(N) PV MODULE
	(N) DC-DC / STRING INVERTER	(N) DC DISCONNECT	STRUCTURALLY DISQUALIFIED

ROOF SECTION CRITERIA AND SPECIFICATIONS

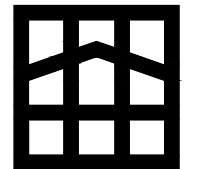
ROOF SECTION	PV MODULE QTY	AZIMUTH	PITCH	TSRF
RSI	10	92	23	77%



04/04/2024



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PROJECT ID
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SITE OWNER
BRIAN REICHEL

SITE ADDRESS
II EAST MADISON STREET
COLORADO SPRINGS, COLORADO 80907

EQUIP. (10) SILFAB SOLAR SIL-420 HC+
(10) ENPHASE IQ8PLUS-72-2-US

SYSTEM SIZE
4.2KW DC
2.9KW STC-AC, 3.748KW CEC-AC

PROJECT DESIGNER
CESAR CULLADOS

DATE
05-APR-2024

SHEET NAME
ROOF PLAN

SHEET #
S-3

REV
0

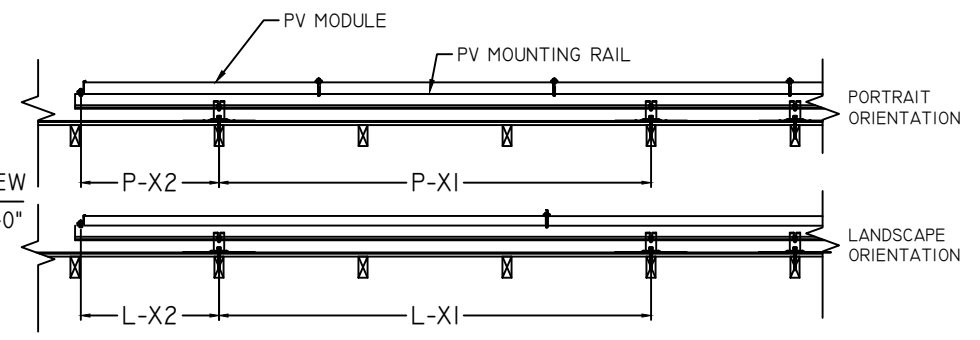
STRUCTURAL INSTALLATION SCHEDULE AND CRITERIA

ROOF MEMBRANE		SPAN AREA	TAG	SPAN
ROOF TYPE:	COMPOSITION SHINGLE	RAIL - PORTRAIT - MODULE ORIENTATION		
ROOF SHEATHING TYPE:	1/2" PLYWOOD	X- SPACING	P-X1	72 IN. O.C. MAX.
		X-CANTILEVER	P-X2	23 IN. MAX.
		Y- SPACING	P-Y1	41.3 IN. MIN. - 45.3 IN. MAX.
		Y-CANTILEVER	P-Y2	15 IN. MIN. - 17 IN. MAX.
ARRAY PARAMETERS		RAIL - LANDSCAPE - MODULE ORIENTATION		
TOTAL ROOF AREA (SQ. FT.)	2180	X- SPACING	L-X1	72 IN. O.C. MAX.
TOTAL PV MODULE AREA (SQ. FT.)	213	X-CANTILEVER	L-X2	23 IN. MAX.
% PV MODULE ROOF COVERAGE	9.77%	Y- SPACING	L-Y1	21.1 IN. MIN. - 25.1 IN. MAX.
		Y-CANTILEVER	L-Y2	7.9 IN. MIN. - 9.8 IN. MAX.
PV RACKING				
RACKING:	ECOFASTEN CLICKFIT STANDARD			
RACKING TYPE:	RAIL			
STANDOFF:	ECOFASTEN CF UNIV L-FOOT MILL 3"			
STANDOFF TYPE:	L-FOOT & FLASHING			
FASTENER:	5/16" X 3-1/2" ZINC PLATED STEEL LAG SCREW			

STRUCTURAL FRAMING					
ROOF SECTION	STRUCTURE TYPE	RAFTER / TC SIZE (IN)	RAFTER / TC SPACING (IN)	STRUCTURAL UPGRADE	UPGRADE SIZE & LENGTH (FT)
RS1	CONVENTIONAL FRAMING	2x6	24	NONE - SINGLE PLY (1x)	NONE

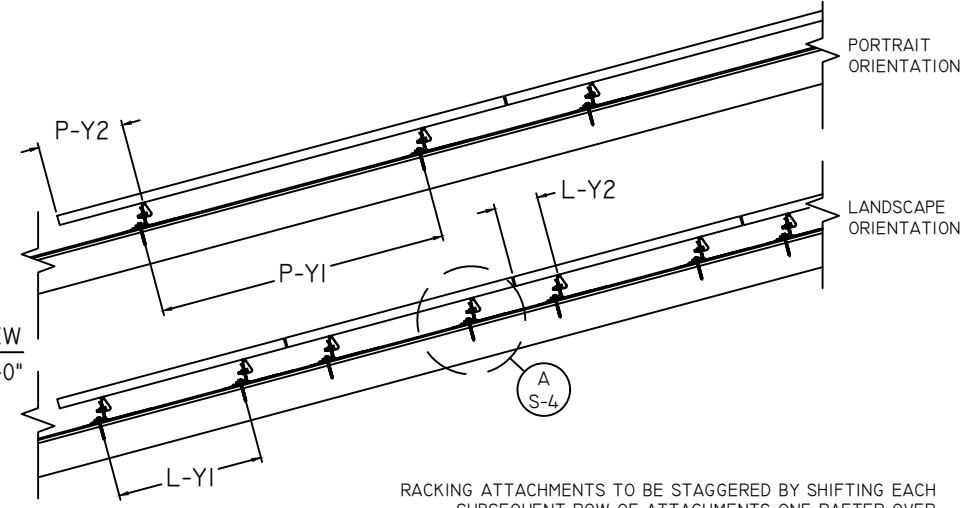
PV ARRAY DETAIL, FRONT VIEW

SCALE: 3/8" = 1'-0"

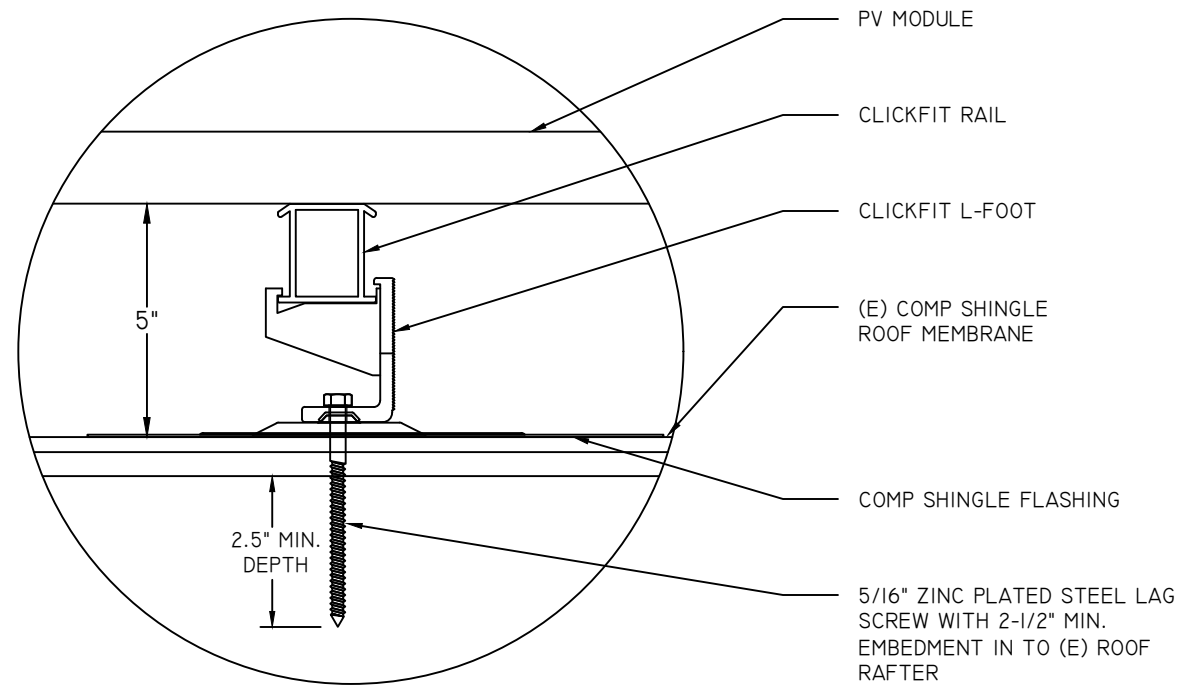
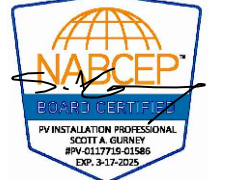


PV ARRAY DETAIL, SIDE VIEW

SCALE: 3/8" = 1'-0"

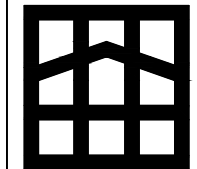


RACKING ATTACHMENTS TO BE STAGGERED BY SHIFTING EACH SUBSEQUENT ROW OF ATTACHMENTS ONE RAFTER OVER TO DISTRIBUTE LOAD ACROSS ALL FRAMING MEMBERS UNDER PV ARRAY.



A COMP SHINGLE - CLICKFIT LFOOT / FLASHING - STANDOFF DETAIL
SCALE: 3" = 1'-0"

ION DEVELOPER LLC
DAVID STANLEY CONRAD
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PROJECT ID
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SITE OWNER
BRIAN REICHEL

SITE ADDRESS
11 EAST MADISON STREET
COLORADO SPRINGS, COLORADO 80907

EQUIP.
(10) SILFAB SOLAR SIL-420 HC+
(10) ENPHASE IQ8PLUS-72-2-US

SYSTEM SIZE
4.2KW DC
2.9KW STC-AC, 3.748KW CEC-AC

PROJECT DESIGNER
CESAR CULLADOS

DATE
05-APR-2024

SHEET NAME
STRUCTURAL DETAILS

SHEET #	REV
S-4	0

PV SYSTEM STRUCTURAL SPECIFICATIONS AND CALCULATIONS

DESIGN LOCATION AND SITE SPECIFICATIONS

JURISDICTION	CITY OF COLORADO SPRINGS
STATE	COLORADO
ADOPTED LOAD STANDARD	ASCE 7-16
OCCUPANCY / RISK CATEGORY	II
BASIC WIND SPEED (MPH (3-SEC GUST))	130
WIND EXPOSURE CATEGORY	C
GROUND SNOW LOAD (PSF) (Pg)	43
BASE ELEVATION (FT)	6100

PV SYSTEM STRUCTURAL SPECIFICATIONS

STRUCTURE TYPE	INHABITED - HIP ROOF
MIN. ROOF SLOPE (DEG.)	23
MEAN ROOF HEIGHT (FT.)	11
PORTRAIT ATT. SPACING (IN. O.C.)	72
LANDSCAPE ATT. SPACING (IN. O.C.)	72
# OF ATTACHMENT POINTS	18
MAX. POINT LOAD (LBS / ATT.)	56.6
MAX. PV DEAD LOAD TO RAFTER (LBS)	113.2

PV SYSTEM EQUIPMENT SPECIFICATIONS

MODULE MANUFACTURER / TYPE	SILFAB SOLAR SIL-420 HC+
SOLAR MODULE WEIGHT (LBS)	47
SOLAR MODULE LENGTH (IN.)	75.3
SOLAR MODULE WIDTH (IN.)	40.8
SOLAR MODULE AREA (SQ. FT)	21.3
PV RACKING	ECOFASTEN CLICKFIT STANDARD
PV RACKING TYPE	RAIL
PV ROOF ATTACHMENT	ECOFASTEN CF UNIV L-FOOT MILL 3"
PV ROOF ATTACHMENT FASTENER	5/16" X 3-1/2" ZINC PLATED STEEL LAG SCREW
RACKING DEAD LOAD (PSF)	0.8
SOLAR MODULE DEAD LOAD (PSF)	2.21
TOTAL PV ARRAY DEAD LOAD (PSF)	3.01

DESIGNED ROOF SNOW LOAD CALCULATIONS

ASCE 7-16 (C&C)	= Ps =
SLOPED ROOF SNOW LOAD (PSF) (Cs)(0.7)(Ce)(Ct)(Is)(Pg)	EQN. 7.4-1
EXPOSURE FACTOR (Ce) =	TABLE 7.3-1
THERMAL FACTOR (Ct) =	TABLE 7.3-2
IMPORTANCE FACTOR (Is) =	TABLE 1.5-2
SLOPE FACTOR (Cs) =	FIG. 7.4-1
Ps (PSF) =	30 OK

DESIGN WIND PRESSURE CALCULATIONS

DESIGN WIND PRESSURE (PSF) = P = qh(GCp)(ye)(ya)	
VELOCITY PRESSURE (PSF) = qh = 0.00256(Kh)(Kzt)(Kd)(Ke)(V^2)	
TERRAIN EXPO. CONSTANT (a) =	9.5
TERRAIN EXPO. CONSTANT (Zg)(FT) =	900
VP EXPOSURE COEFF. (Kh) =	0.80
TOPOGRAPHIC FACTOR (Kzt) =	1.0
WIND DIRECTIONALITY FACTOR (Kd) =	0.85
ARRAY EDGE FACTOR (ye) =	1
QH (PSF) =	29.24

ASCE 7-16 (C&C)

EQN. 26.10-1	
TABLE 26.13-1	
TABLE 26.11-1	
TABLE 26.11-1	
EQN. C26.10-1	
EQN. 26.8-1	
TABLE 26.6-1	
EQN. 29.4-7	
FIG. 29.4-8	
EQN. 26.10-1	

GRAVITY LOAD / FRAMING CALCULATIONS

DEAD LOAD (PSF)	RSI
ROOF MEMBRANE	COMPOSITION SHINGLE 4.0
SHEATHING	1/2" PLYWOOD 1.7
PITCH (DEG)	23
FRAMING	CONVENTIONAL FRAMING - NONE - SINGLE PLY (IX) - RAFTER 2X6 @ 24 IN. O.C. - DF #2 @ 11.5 FT. MAX SPAN 1.4

RAIL - COMPRESSION / UPLIFT

ECOFASTEN CLICKFIT STANDARD	CONTINUOUS SPAN BM = (wL^2)/8
MAXIMUM HORIZONTAL RAIL SPAN (FT.) =	6.0
MAXIMUM VERTICAL SPACING BETWEEN RAILS (FT.) =	3.8
TOTAL LOAD (PSF) =	31.8
TOTAL LOAD ADJ. TO ROOF SLOPE (W)(LB. / FT.) =	-28.8
ALLOWABLE MANU. BENDING MOMENT (LB. / FT.) =	422
ACTUAL MAX. BENDING MOMENT (LB / FT.) =	129.6
	OK

PV ARRAY	3.0
TOTAL ROOF DEAD LOAD	10.1
ADJUSTED TO SLOPED ROOF	11.1
GREATER OF LIVE / SNOW LOAD	30.0
LIVE LOAD (PSF)	20.0
TOTAL GREATEST LIVE OR PV LOAD (PSF)	41.1
IBC 1607.14.4.1	

CONNECTIONS - UPLIFT / DOWNWARD

HIP ROOF 20° < θ ≤ 27°	UPLIFT	DOWNWARD		
	ZONE 1	ZONE 2R		
	ZONE 2E	ALL ZONES		
RAIL - PORTRAIT MODULE ORIENTATION	72 IN. O.C.	72 IN. O.C.	72 IN. O.C.	72 IN. O.C.
SOLAR PANEL PRESSURE EQ. FACTOR (ya) =	0.80	0.80	0.80	0.80
EXTERNAL PRESSURE COEFF. (GCp) =	-1.4	-2.0	-2.0	0.9
ASD PRESSURE (0.6P)(PSF) =	-19.65	-28.07	-28.07	35.09
TRIBUTARY AREA (SQ. FT) =	18.8	18.8	9.4	
MAX. UPLIFT (0.6D+0.6P) (LBS) =	-336.0	-494.5	-247.3	
RAIL - LANDSCAPE MODULE ORIENTATION	72 IN. O.C.	72 IN. O.C.	72 IN. O.C.	72 IN. O.C.
SOLAR PANEL PRESSURE EQ. FACTOR (ya) =	0.80	0.80	0.80	0.80
EXTERNAL PRESSURE COEFF. (GCp) =	-1.4	-2.0	-2	0.7
ASD PRESSURE (0.6P)(PSF) =	-19.65	-28.07	-28.07	27.29
TRIBUTARY AREA (SQ. FT) =	10.20	10.20	5.10	
MAX. UPLIFT (0.6D+0.6P) (LBS) =	-182.0	-268.0	-134.0	

RAFTER / TOP CHORD MEMBER PROPERTIES	DF #2 - 2x6 - NONE - SINGLE PLY (IX)
SECTION MODULUS (S)(IN^3)	7.56
MOMENT OF INERTIA (I)(IN^4)	20.80
TOTAL LOAD ON MEMBER (W) (PLF)	82.1
MEMBER SPAN 1 (L) (FT)	11.5
MEMBER SPAN 2 (K) (FT)	5.2
MIN. EAWE SPAN (V) (FT)	1.5
MODULUS OF ELASTICITY (E) (PSI)	1600000
SHEAR (Fv) (PSI)	180
AREA (A) (IN^2)	8.25

MAX BENDING STRESS CHECK	(Fb)(Cd)(Cf)(Cr)
BENDING (Fb) (PSI)	900
LOAD DURATION FACTOR (Cd)	1.25
SIZE FACTOR (Cf)	1.30
REPETITIVE MEMBER FACTOR (Cr)	1.15
ALLOWABLE BENDING STRESS (PSI)	1681.9

ACTUAL BENDING STRESS (PSI)	((WL^3)+(WK^3))/8(S)(L+K)
	1620.5
	96% OK

ROOF ATTACHMENT / FASTENER CHECK

ECOFASTEN CF UNIV L-FOOT MILL 3" - 5/16" X 3-1/2" ZINC PLATED STEEL LAG SCREW	NDS 12.2
LAG SCREW WITHDRAWAL DESIGN VALUE (LBS) = W = 1800(G^3/2)(D^3/4)	12.2.1
ROOF ATTACHMENT FASTENER (D) (IN.) =	5/16
FASTENER QTY PER ATTACHMENT =	1
FASTENER EMBEDMENT DEPTH (IN.) =	2.5
LUMBER SPECIFIC GRAVITY (G) =	0.5
LOAD DURATION FACTOR (Cd) =	1.6
PRying COEFFICIENT =	1.4
WITHDRAWAL DESIGN VALUE(W)(LBS / IN.) =	266.0
LAG SCREW WITHDRAWAL CAPACITY (LBS) =	760.0
MANUFACTURER MAX. UPLIFT CAPACITY (LBS) =	895.0
MAX. ATT. WITHDRAWAL CAPACITY (LBS) =	760.0
MAX. ATT. WITHDRAWAL STRESS (LBS) =	494.5
	OK

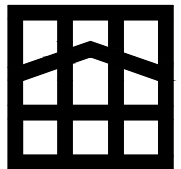
MAX DEFLECTION CHECK - TOTAL LOAD	L / 120
ALLOWABLE DEFLECTION	1.150 IN.
ACTUAL MAX DEFLECTION	0.403 IN.
(W)(L)^4 / 185(E)(I)	35% OK

MAX DEFLECTION CHECK - LIVE LOAD	L / 180
ALLOWABLE DEFLECTION	0.575 IN.
ACTUAL MAX DEFLECTION	0.196 IN.
(W)(L)^4 / 185(E)(I)	34% OK

MAX SHEAR CHECK	
ALLOWABLE SHEAR = Fv (A)	1485 LBS
ACTUAL MAX SHEAR = (W)(L)/2	472 LBS
	32% OK



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SITE OWNER
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SITE ADDRESS
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COLORADO SPRINGS, COLORADO 80907

EQUIP.
(10) SILFAB SOLAR SIL-420 HC+
(10) ENPHASE IQ8PLUS-72-2-US

SYSTEM SIZE
4.2KW DC
2.9KW STC-AC, 3.748KW CEC-AC

PROJECT DESIGNER
CESAR CULLADOS

DATE
05-APR-2024

SHEET NAME
STRUCTURAL CALCULATIONS

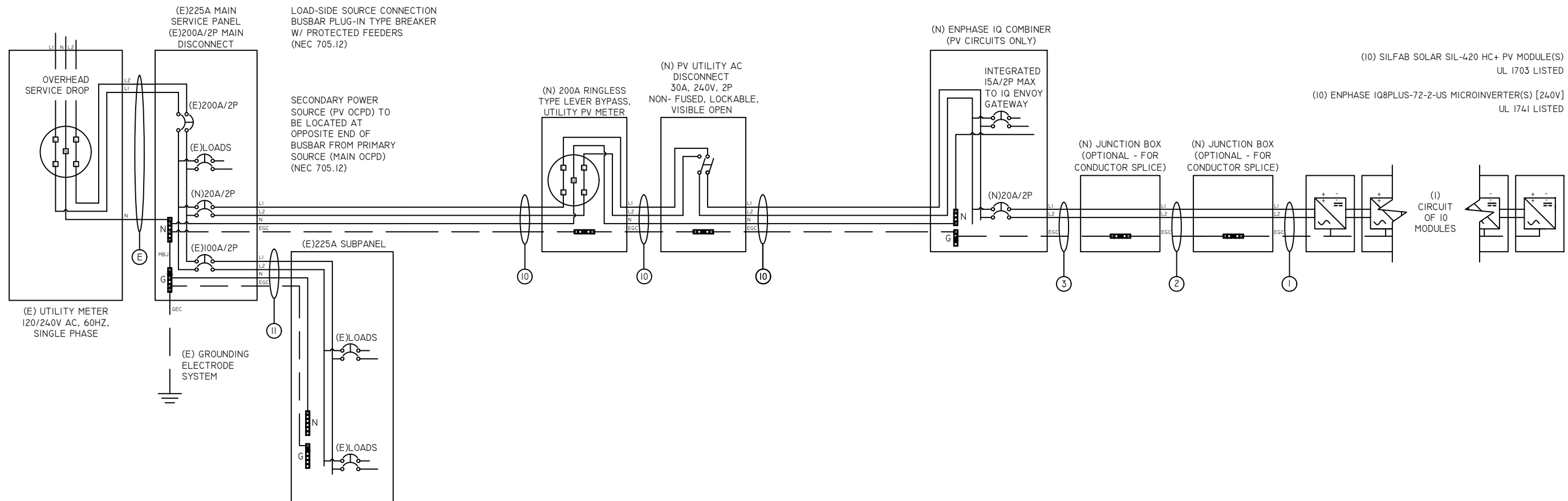
SHEET #
S-5

REV
0

CONDUCTOR AND RACEWAY SCHEDULE

TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V	TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V	TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V	TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V
10	(1)	6 AWG	THHN / THWN-2, CU.	BLACK (L1)	12.1A AC (MAX)	3	(1)	10 AWG	THHN / THWN-2, CU.	BLACK (L1)	12.1A AC (MAX)	2	(1)	10 AWG	2C, NM-B W/G, CU. (CABLE)	(L1, L2, EGC)	12.1A AC (MAX)	1	(1)	12 AWG	2C, TC-ER, CU.	(L1, L2)	12.1A AC (MAX)
	(1)	6 AWG	THHN / THWN-2, CU.	RED (L2)	240 V AC		(1)	10 AWG	THHN / THWN-2, CU.	RED (L2)	240 V AC		(1)	6 AWG	SOLID BARE CU.	(EGC)	240 V AC						
	(1)	6 AWG	THHN / THWN-2, CU.	WHITE (N)			(1)	10 AWG	THHN / THWN-2, CU.	GREEN (EGC)													
	(1)	6 AWG	THHN / THWN-2, CU.	GREEN (EGC)			(1)	3/4 IN.	EMT	(RACEWAY)													
	(1)	3/4 IN.	EMT	(RACEWAY)	EXTERIOR						EXTERIOR						INTERIOR						EXTERIOR
11	(E)	2/0 AWG	THHN / THWN, CU.	BLACK (L1)	12.1A AC (MAX)																		
	(E)	2/0 AWG	THHN / THWN, CU.	RED (L2)	240 V AC																		
	(E)	2/0 AWG	THHN / THWN, CU.	WHITE (N)																			
	(E)	6 AWG	THHN / THWN, CU.	GREEN (EGC)																			
	(E)	--	--	(RACEWAY)	EXTERIOR																		

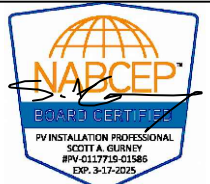
ELECTRICAL LINE DIAGRAM



ELECTRICAL LINE DIAGRAM NOTES

SOLAR INSTALLATION SHALL COMPLY WITH NEC 334.10 AND NEC 334.12 AS APPLICABLE

SOLAR EQUIPMENT WILL BE INSTALLED A MINIMUM OF 3 FEET AWAY FROM THE GAS REGULATOR.
 IF THE EXISTING UTILITY METER IS FOUND TO BE BELOW 5 FEET OR ABOVE 6 FEET WE WILL RELOCATE THE METER TO BE WITHIN CSU'S REQUIREMENTS UNLESS A VARIANCE IS APPROVED. IF THE EXISTING UTILITY METER IS TO BE REPLACED OR UPGRADED, THE NEW UTILITY SERVICE METER WILL BE A 200A, RINGLESS, BYPASS METER.
 PV METER MAKE/MODEL: MILBANK U480I-XL-5T9 OR EATON UHTRS213CE
 WIRE MAY BE SPLICED/PIGTAILED DOWN TO MEET MAXIMUM WIRE SPECIFICATIONS FOR EQUIPMENT SO LONG AS THE WIRE AMPACITY REMAINS ABOVE 125% OF THE MAXIMUM INVERTER OUTPUT CIRCUIT CURRENT OF THE SYTEM, WHICH IS SHOWN ON SHEET E-7.



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PROJECT ID	00CFQV
SITE OWNER	BRIAN REICHEL
SITE ADDRESS	11 EAST MADISON STREET COLORADO SPRINGS, COLORADO 80907
EQUIP.	(10) SILFAB SOLAR SIL-420 HC+ (10) ENPHASE IQ8PLUS-72-2-US
SYSTEM SIZE	4.2KW DC 2.9KW STC-AC, 3.748KW CEC-AC
PROJECT DESIGNER	CESAR CULLADOS
DATE	05-APR-2024
SHEET NAME	ELECTRICAL LINE DIAGRAM
SHEET #	E-6
REV	0

PV SYSTEM ELECTRICAL SPECIFICATIONS AND CALCULATIONS

DESIGN LOCATION AND TEMPERATURES

TEMPERATURE DATA SOURCE	ASHRAE
STATE	COLORADO
JURISDICTION	CITY OF COLORADO SPRINGS
WEATHER STATION	COLORADO SPRINGS MUNI AP
ASHRAE EXTREME LOW TEMP (°C)	-23
ASHRAE 2% HIGH TEMP (°C)	32
DESIGNED MAX. SYSTEM VDOP / VRISE	4.00%

PV MODULE SPECIFICATIONS

RATED POWER (P _{MAX}) (W)	420
MAXIMUM POWER VOLTAGE (V _{MP})	39.19
MAXIMUM POWER CURRENT (I _{MP})	10.72
OPEN CIRCUIT VOLTAGE (V _{OC})	45.67
SHORT CIRCUIT CURRENT (I _{SC})	11.46
PMP/VMP TEMP. COEFFICIENT	-0.36
VOC TEMP. COEFFICIENT	-0.28
SERIES FUSE RATING	20
ADJ. MODULE VOC @ ASHRAE LOW TEMP	51.8
ADJ. MODULE VMP @ ASHRAE 2% AVG. HIGH TEMP	33.7

INVERTER SPECIFICATIONS

TYPE	ENPHASE IQ8PLUS-72-2-US
MAX. OR RECOMMENDED MODULE POWER (W)	440
MAXIMUM INPUT DC OPEN-CIRCUIT VOLTAGE (V _{OC})	60
MINIMUM START VOLTAGE (V)	30
MAXIMUM START VOLTAGE(V)	58
MAXIMUM INPUT CURRENT (I _{SC}) (A)	15
MAX CONTINUOUS OUTPUT POWER (VA)	290
MAX. CONTINUOUS OUTPUT CURRENT (A)	1.21
NOMINAL (L-L) OUTPUT VOLTAGE	240
CEC WEIGHTED EFFICIENCY (%)	97.0%

SYSTEM ELECTRICAL SPECIFICATIONS

NUMBER OF MODULES PER CIRCUIT	10
DC POWER RATING PER CIRCUIT (STC)(W DC)	4200
TOTAL MODULE QUANTITY	10 PV MODULES
STC DC POWER RATING OF ARRAY	4200W DC
INVERTER OUTPUT CIRCUIT CURRENT(A AC)	12.1
I25% INVERTER OUTPUT CIRCUIT CURRENT(A AC)	15.13
CIRCUIT OCPD RATING (A)	20
COMBINED INVERTER CONTINUOUS OUTPUT CURRENT	12.1A AC
PV POWER PRODUCTION SYSTEM OCPD RATING (X125%)	20A
MAX. ARRAY STC-AC POWER (W)	2900W AC (STC)
MAX. ARRAY CEC-AC POWER (W)	3748W AC (CEC)

AC VOLTAGE RISE CALCULATIONS

	DIST (FT)	COND.	VRISE(V)	VEND(V)	%VRISE
VRISE SEC. 1 (MICRO TO JBOX) *	28.8	12 Cu.	1.4	241.4	0.58%
VRISE SEC. 2 (JBOX TO COMBINER BOX)	50	10 Cu.	1.5	241.5	0.61%
VRISE SEC. 3 (COMBINER BOX TO POI)	10	6 Cu.	0.1	240.1	0.05%
TOTAL VRISE			3.0	243.0	1.24% OK

* 8 MICROINVERTER MAX SUB-BRANCH CIRCUIT SIZE TO COMPLY WITH VRISE CALCULATIONS.

RACEWAY / CONDUCTOR CALCULATIONS

MICROINV. TO JUNCTION BOX (1)

MAX INVERTER OUTPUT CIRCUIT CURRENT =	12.1 A AC
CONDUCTOR SIZE / INSULATION / TYPE =	12 AWG 2C, TC-ER, CU.
CONDUCTOR AMP. RATING @ 90°C =	30 A

PER NEC 690.8(B)(1)(W/OUT CORRECTION FACTORS)	
MAX INVERTER OUTPUT CURRENT X125%=	15.0 A AC

PER NEC 690.8(B)(2)(WITH CORRECTION FACTORS)	
AMB. TEMP. AMP. CORRECTION =	0.96
# OF CONDUCTORS IN RACEWAY CORRECTION =	1.0
ADJUSTED CONDUCTOR AMPACITY (A) =	28.8 A AC

LARGER AMPACITY OF 690.8(B)(1) OR (B)(2) =	15.0 < 28.8
(B)(1) - W/OUT CORRECTION FACTORS	
LARGER AMPACITY COMPLIANCE =	30.0 > 15.0 OK

RACEWAY SIZE / TYPE =	3/4 IN. EMT OR NO RACEWAY
CONDUCTOR(S) / CABLE(S) CROSS-SECTION AREA (IN. ²) =	0.142 IN. ²
CROSS-SECTIONAL AREA OF RACEWAY(IN. ²) =	0.533 IN. ²
% ALLOWABLE RACEWAY FILL (NEC CH. 9, TBL 1) =	53% > 27% OK

JUNCTION BOX TO JUNCTION BOX (2)

MAX INVERTER OUTPUT CIRCUIT CURRENT =	12.1 A AC
CONDUCTOR SIZE / INSULATION / TYPE =	10 AWG 2C, NM-B W/G, CU.
CONDUCTOR AMP. RATING @60°C =	30 A

PER NEC 690.8(B)(1)(W/OUT CORRECTION FACTORS)	
MAX INVERTER OUTPUT CURRENT X125%=	15.0 A AC

PER NEC 690.8(B)(2)(WITH CORRECTION FACTORS)	
AMB. TEMP. AMP. CORRECTION =	0.91
# OF CONDUCTORS IN RACEWAY CORRECTION =	1.0
ADJUSTED CONDUCTOR AMPACITY (A) =	27.3 A AC

LARGER AMPACITY OF 690.8(B)(1) OR (B)(2) =	15.0 < 27.3
(B)(1) - W/OUT CORRECTION FACTORS	
LARGER AMPACITY COMPLIANCE =	30.0 > 15.0 OK

RACEWAY SIZE / TYPE =	NO RACEWAY
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JUNCTION BOX TO COMBINER BOX (3)

MAX INVERTER OUTPUT CIRCUIT CURRENT =	12.1 A AC
CONDUCTOR SIZE / INSULATION / TYPE =	10 AWG THHN / THWN-2, CU.
CONDUCTOR AMP. RATING @75°C =	30 A

PER NEC 690.8(B)(1)(W/OUT CORRECTION FACTORS)	
MAX INVERTER OUTPUT CURRENT X125%=	15.0 A AC

PER NEC 690.8(B)(2)(WITH CORRECTION FACTORS)	
AMB. TEMP. AMP. CORRECTION =	0.94
# OF CONDUCTORS IN RACEWAY CORRECTION =	1.0
ADJUSTED CONDUCTOR AMPACITY (A) =	28.2 A AC

LARGER AMPACITY OF 690.8(B)(1) OR (B)(2) =	15.0 < 28.2
(B)(1) - W/OUT CORRECTION FACTORS	
LARGER AMPACITY COMPLIANCE =	30.0 > 15.0 OK

RACEWAY SIZE / TYPE =	3/4 IN. EMT
CONDUCTOR(S) / CABLE(S) CROSS-SECTION AREA (IN. ²) =	0.063 IN. ²
CROSS-SECTIONAL AREA OF RACEWAY(IN. ²) =	0.533 IN. ²
% ALLOWABLE RACEWAY FILL (NEC CH. 9, TBL 1) =	40% > 12% OK

COMBINER BOX TO MAIN PV OCPD (10)

COMBINED INVERTER CONTINUOUS OUTPUT CURRENT =	12.1 A AC
CONDUCTOR SIZE / INSULATION / TYPE =	6 AWG THHN / THWN-2, CU.
CONDUCTOR AMP. RATING @75°C =	65 A

PER NEC 690.8(B)(1)(W/OUT CORRECTION FACTORS)	
MAX COMBINED INVERTER CONTINUOUS OUTPUT CURRENT X125%=	15.0 A AC

PER NEC 690.8(B)(2)(WITH CORRECTION FACTORS)	
AMB. TEMP. AMP. CORRECTION =	0.94
# OF CONDUCTORS IN RACEWAY CORRECTION =	1.0
ADJUSTED CONDUCTOR AMPACITY (A) =	61.1 A AC

LARGER AMPACITY OF 690.8(B)(1) OR (B)(2) =	15.0 < 61.1
(B)(1) - W/OUT CORRECTION FACTORS	
LARGER AMPACITY COMPLIANCE =	65.0 > 15.0 OK

RACEWAY SIZE / TYPE =	3/4 IN. EMT
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CONDUCTOR(S) / CABLE(S) CROSS-SECTION AREA (IN. ²) =	0.203 IN. ²
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CROSS-SECTIONAL AREA OF RACEWAY(IN. ²) =	0.533 IN. ²
% ALLOWABLE RACEWAY FILL (NEC CH. 9, TBL 1) =	40% > 38% OK



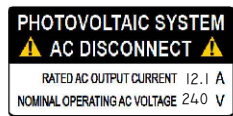
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EC
EC.0100960



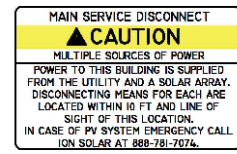
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PROJECT ID	00CFQV
SITE OWNER	BRIAN REICHEL
SITE ADDRESS	11 EAST MADISON STREET COLORADO SPRINGS, COLORADO 80907
EQUIP.	(10) SILFAB SOLAR SIL-420 HC+ (10) ENPHASE IQ8PLUS-72-2-US
SYSTEM SIZE	4.2KW DC 2.9KW STC-AC, 3.748KW CEC-AC
PROJECT DESIGNER	CESAR CULLADOS
DATE	05-APR-2024
SHEET NAME	ELECTRICAL CALCULATIONS
SHEET #	E-7
REV	0

ELECTRICAL FIELD-APPLIED HAZARD MARKINGS



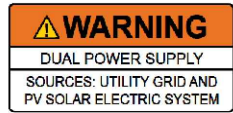
E AT EACH PV SYSTEM DISCONNECTING MEANS. [NEC 690.54, NEC 690.13(B)]



N PERMANENT DIRECTORY TO BE LOCATED AT MAIN SERVICE EQUIPMENT LOCATION IF ALL ELECTRICAL POWER SOURCE DISCONNECTING MEANS (SOLAR ARRAY RAPID SHUTDOWN SWITCH) ARE GROUPED AND IN LINE OF SITE OF MAIN SERVICE DISCONNECTING MEANS. [NEC 690.56(C) & NEC 705.10].



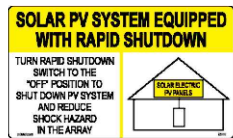
F FOR PV DISCONNECTING MEANS WHERE ALL TERMINALS OF THE DISCONNECTING MEANS MAY BE ENERGIZED IN THE OPEN POSITION. [NEC 690.13(B), NEC 705.22]



G AT EQUIPMENT CONTAINING OVERCURRENT DEVICES IN CIRCUITS SUPPLYING POWER TO A BUSBAR OR CONDUCTOR SUPPLIED FROM MULTIPLE SOURCES. [NEC 705.12(C)]



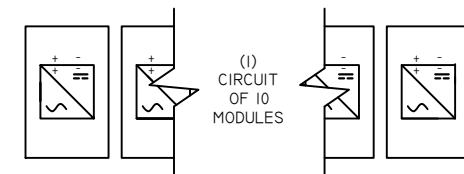
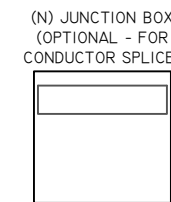
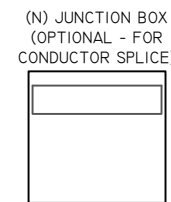
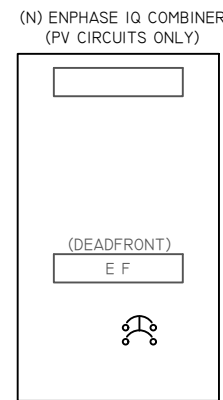
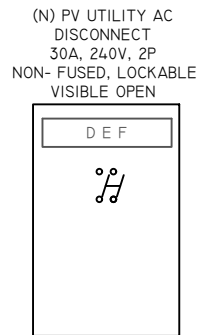
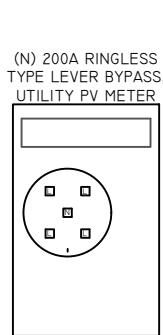
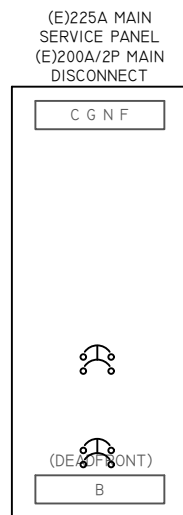
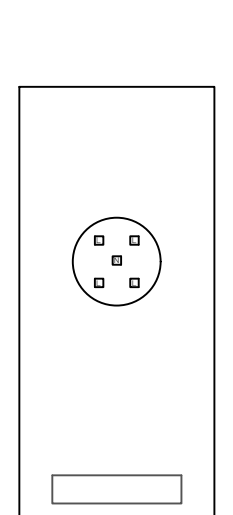
B PLACED ADJACENT TO PV SYSTEM PLUG-IN TYPE BREAKER TO A BUSBAR FOR A LOAD SIDE CONNECTION. [NEC 705.12(B)(3)(2)]



C SIGN LOCATED ON OR NO MORE THAN 3 FT FROM THE RAPID SHUT DOWN DISCONNECT SWITCH(S). IF MORE THAN ONE PV RSD IS IN AN ENCLOSURE, EACH SHALL BE LABELED. [NEC 690.56(C), NEC 690.12(C)]



D FOR RAPID SHUTDOWN SWITCH INITIATION DEVICE LOCATED AT A READILY ACCESSIBLE OUTDOOR LOCATION. [NEC 690.12]



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PROJECT ID
00CFQV

SITE OWNER
BRIAN REICHEL

SITE ADDRESS
11 EAST MADISON STREET
COLORADO SPRINGS, COLORADO 80907

EQUIP. (I0) SILFAB SOLAR SIL-420 HC+
(I0) ENPHASE IQ8PLUS-72-2-US

SYSTEM SIZE 4.2KW DC
2.9KW STC-AC, 3.748KW CEC-AC

PROJECT DESIGNER
CESAR CULLADOS

DATE
05-APR-2024

SHEET NAME
ELECTRICAL LABELS

SHEET # REV
E-9 0

ALL CAUTION, WARNING, OR DANGER SIGNS OR LABELS SHALL:

1. COMPLY WITH ANSI Z535.4-2011 STANDARDS.
2. BE PERMANENTLY AFFIXED TO THE EQUIPMENT OR WIRING METHOD AND SHALL NOT BE HANDWRITTEN.
3. SHALL BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.
4. UNLESS OTHERS SPECIFIED MINIMUM TEXT HEIGHT TO BE 1/8" (3MM).