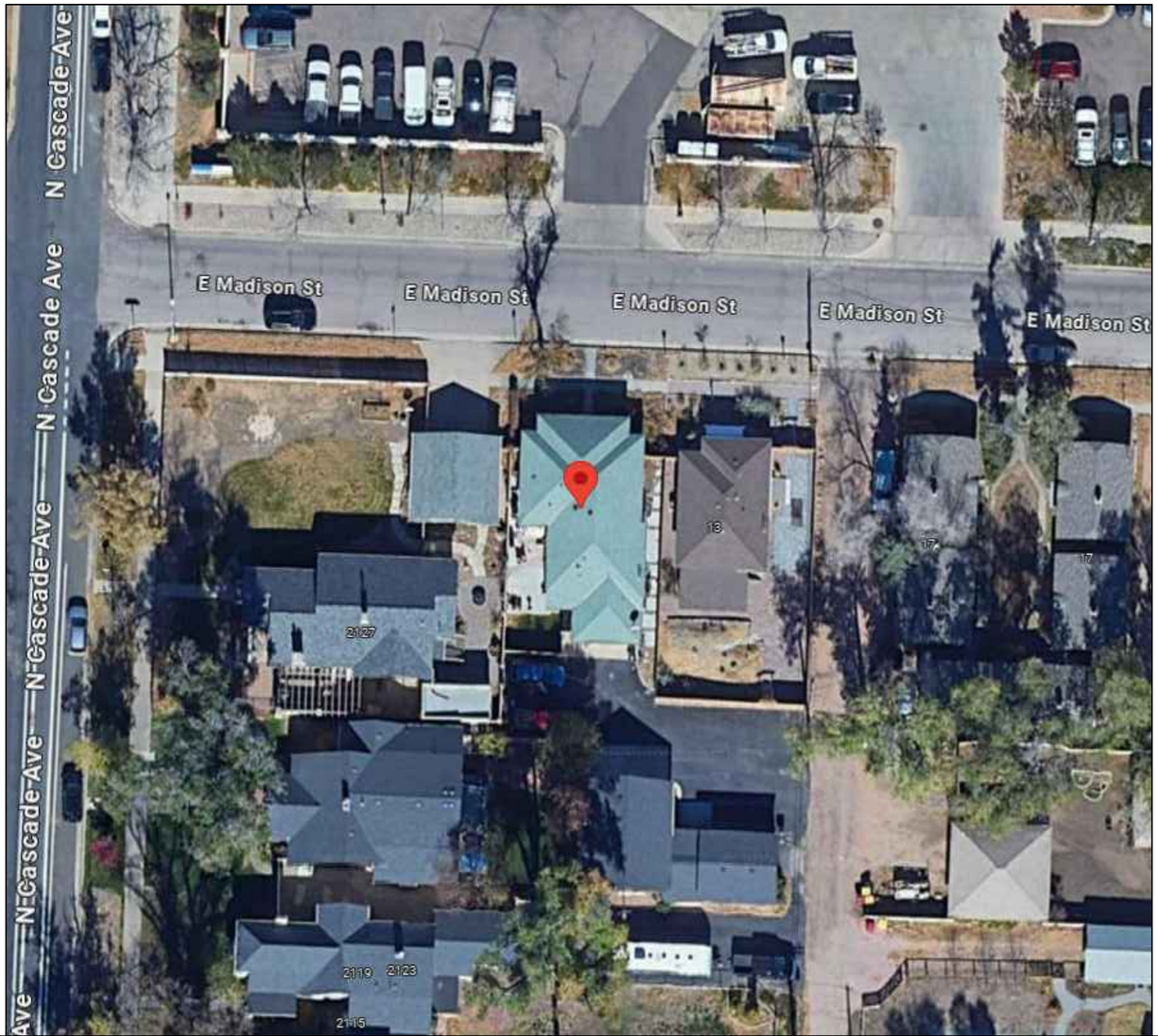
AERIAL SITE VIEW



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

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 UL1703, 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

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DAVID STANLEY CONRAD
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EC.0100960

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OREM, UTAH 84057
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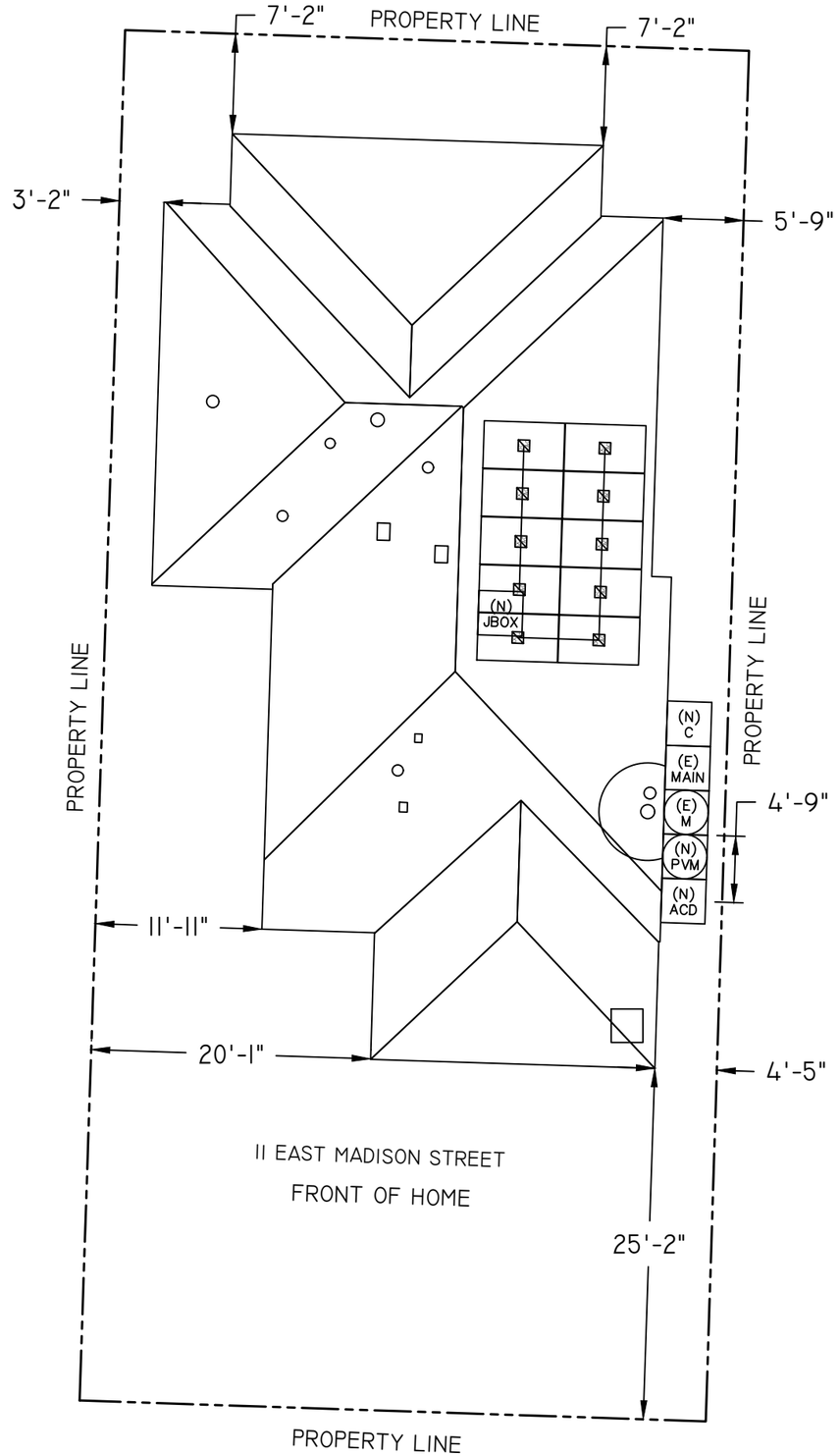
PROJECT ID	00CFQV
SITE OWNER	BRIAN REICHEL
SITE ADDRESS	11 EAST MADISON STREET COLORADO SPRINGS, COLORADO 80907
EQUIP.	(10) SILFAB SOLAR SIL-420 HC+ (10) ENPHASE IQ8PLUS-72-2-US
SYSTEM SIZE	4.2KW DC 2.9KW STC-AC, 3.748KW CEC-AC
PROJECT DESIGNER	CESAR CULLADOS
DATE	05-APR-2024
SHEET NAME	COVER SHEET
SHEET #	G-1
REV	0



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

0' 2'-8" 5'-4" 10'-8" 21'-4"

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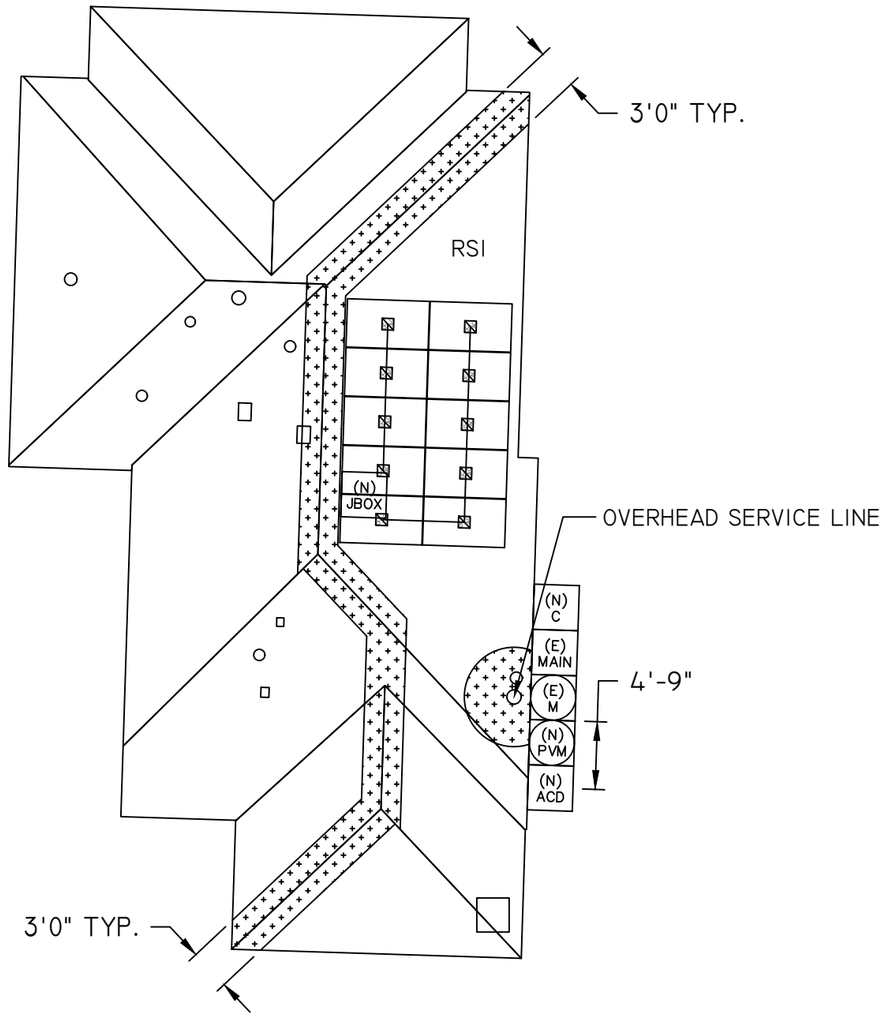
PROJECT ID	00CFQV
SITE OWNER	BRIAN REICHEL
SITE ADDRESS	11 EAST MADISON STREET COLORADO SPRINGS, COLORADO 80907
EQUIP.	(10) SILFAB SOLAR SIL-420 HC+ (10) ENPHASE IQ8PLUS-72-2-US
SYSTEM SIZE	4.2KW DC 2.9KW STC-AC, 3.748KW CEC-AC
PROJECT DESIGNER	CESAR CULLADOS
DATE	05-APR-2024
SHEET NAME	SITE PLAN
SHEET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

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%

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

0' 2'-8" 5'-4" 10'-8" 21'-4"

SYSTEM LEGEND

- (E) M — (E) UTILITY METER / MAIN SERVICE PANEL
- (E) MAIN — (E) MAIN SERVICE PANEL
- (E) SUB — (E) SUBPANEL
- (N) C — (N) PV COMBINER PANEL
- (N) LC — (N) PV LOAD CENTER
- (N) PVM — (N) PV PRODUCTION METER
- (N) I — (N) DC-DC / STRING INVERTER
- (N) JBOX — (N) JUNCTION BOX
- (N) ACD — (N) AC DISCONNECT (VISIBLE-OPEN LOCKABLE LABELED DISCONNECT)
- DC/AC — (N) MICROINVERTER
- (N) DCD — (N) DC DISCONNECT
- S# — SUNEYE LOCATION
- FIRE SETBACK
- (N) PV MODULE
- STRUCTURALLY DISQUALIFIED

ROOF SECTION CRITERIA AND SPECIFICATIONS

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

N

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PROJECT ID
00CFQV

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 #	REV
S-3	0

STRUCTURAL INSTALLATION SCHEDULE AND CRITERIA

ROOF MEMBRANE	
ROOF TYPE:	COMPOSITION SHINGLE
ROOF SHEATHING TYPE:	1/2" PLYWOOD

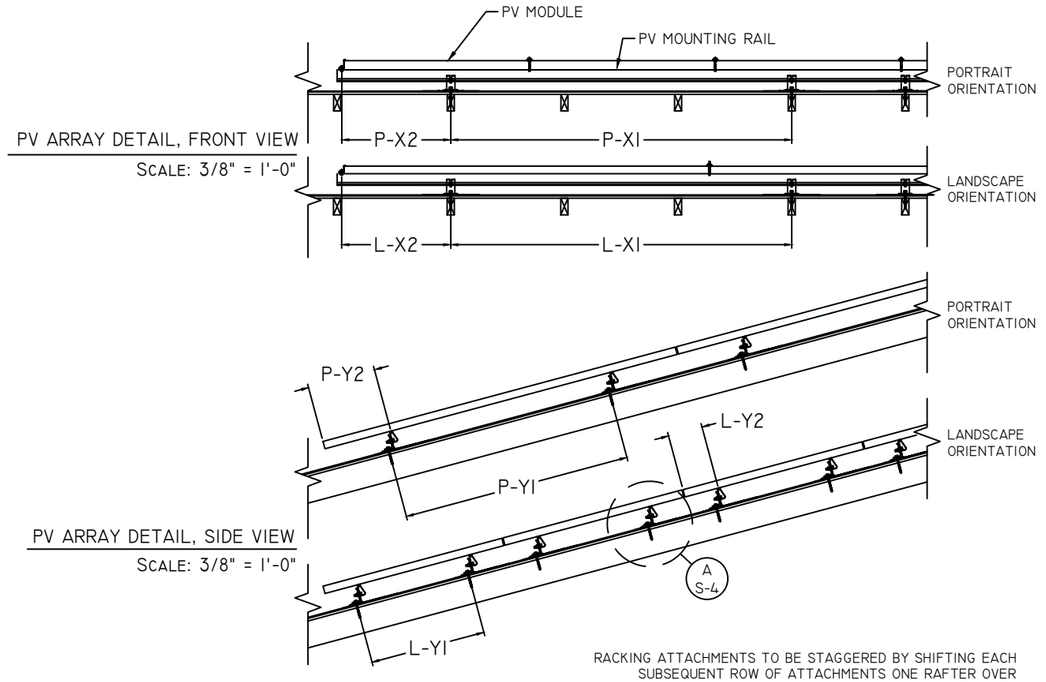
ARRAY PARAMETERS	
TOTAL ROOF AREA (SQ. FT.)	2180
TOTAL PV MODULE AREA (SQ. FT.)	213
% PV MODULE ROOF COVERAGE	9.77%

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

SPAN AREA	TAG	SPAN
RAIL - PORTRAIT - MODULE ORIENTATION		
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.
RAIL - LANDSCAPE - MODULE ORIENTATION		
X- SPACING	L-X1	72 IN. O.C. MAX.
X-CANTILEVER	L-X2	23 IN. MAX.
Y- SPACING	L-Y1	21.1 IN. MIN. - 25.1 IN. MAX.
Y-CANTILEVER	L-Y2	7.9 IN. MIN. - 9.8 IN. MAX.

STRUCTURAL FRAMING

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



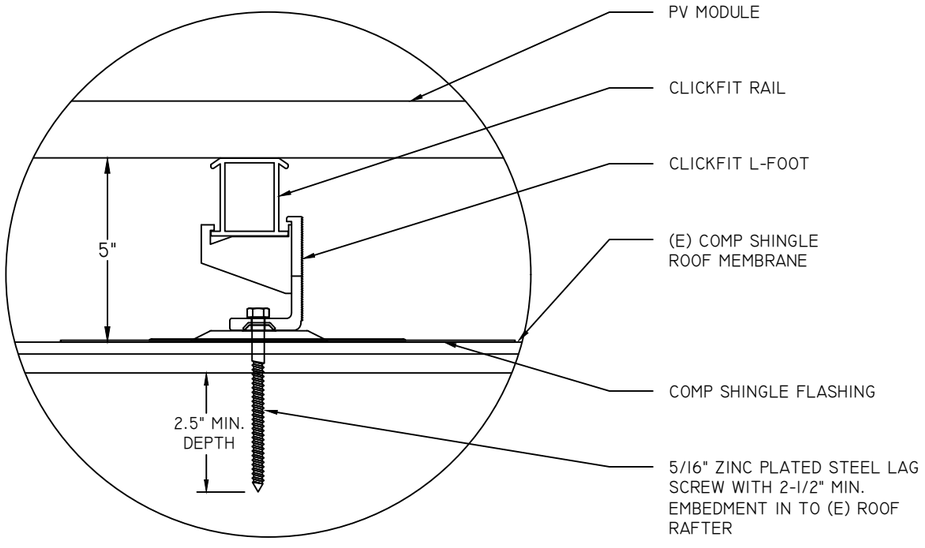
PV ARRAY DETAIL, FRONT VIEW

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"

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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)

SLOPED ROOF SNOW LOAD (PSF) = Ps = (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 — ASCE 7-16 (C&C)

DESIGN WIND PRESSURE (PSF) = P = qH(GCp)(γE)(γA) — EQN. 26.10-1

VELOCITY PRESSURE (PSF) = qH = 0.00256(KH)(KZT)(KD)(KE)(V^2) — TABLE 26.13-1

TERRAIN EXPO. CONSTANT (α) =	9.5	TABLE 26.11-1
TERRAIN EXPO. CONSTANT (Zg)(FT) =	900	TABLE 26.11-1
VP EXPOSURE COEFF.(KH) =	0.80	EQN. C26.10-1
TOPOGRAPHIC FACTOR (KZT) =	1.0	EQN. 26.8-1
WIND DIRECTIONALITY FACTOR (KD) =	0.85	TABLE 26.6-1
ARRAY EDGE FACTOR (γE) =	1	EQN. 29.4-7
QH (PSF) =	29.24	FIG. 29.4-8
		EQN. 26.10-1

RAIL - COMPRESSION / UPLIFT

ECOFASTEN CLICKFIT STANDARD — CONTINOUS SPAN BM = (wL^2)/8

MAXIMUM HORIZONTAL RAIL SPAN (FT.) =	6.0	
MAXIMUM VERTICAL SPACING BETWEEN RAILS (FT.) =	3.8	
	COMPRESSION	UPLIFT
TOTAL LOAD (PSF) =	31.8	27.4
TOTAL LOAD ADJ. TO ROOF SLOPE (W)(LB. / FT.) =	-28.8	86.1
ALLOWABLE MANU. BENDING MOMENT (LB. / FT.) =	422	517
ACTUAL MAX. BENDING MOMENT (LB / FT.) =	129.6	387.4
	OK	OK

CONNECTIONS - UPLIFT / DOWNWARD

HIP ROOF 20° < Ø ≤ 27° — FIGURE 30.3-2G

	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 (γA) =	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 (γA) =	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	

ROOF ATTACHMENT / FASTENER CHECK — NDS 12.2

ECOFASTEN CF UNIV L-FOOT MILL 3" - 5/16" X 3-1/2" ZINC PLATED STEEL LAG SCREW

LAG SCREW WITHDRAWAL DESIGN VALUE (LBS) = W = 1800(G^3/2)(D^3/4) — 12.2.1

ROOF ATTACHMENT FASTENER (D) (IN.) =	5/16	TABLE 2.3.2
FASTENER QTY PER ATTACHMENT =	1	TABLE 12.3.3A
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 WITHDRAWL CAPACITY (LBS) =	760.0	
MANUFACTURER MAX. UPLIFT CAPACITY (LBS) =	895.0	
MAX. ATT. WITHDRAWAL CAPACITY (LBS) =	760.0	
MAX. ATT. WITHDRAWL STRESS (LBS) =	494.5	OK

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

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		

RAFTER / TOP CHORD MEMBER PROPERITES	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. EAVE 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
	((WL^3)+(WK^3))/8(S)(L+K)
ACTUAL BENDING STRESS (PSI)	1620.5
	96% OK

	UNIFORM DISTRIBUTED	
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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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
STRUCTURAL CALCULATIONS

SHEET #	REV
S-5	0

CONDUCTOR AND RACEWAY SCHEDULE

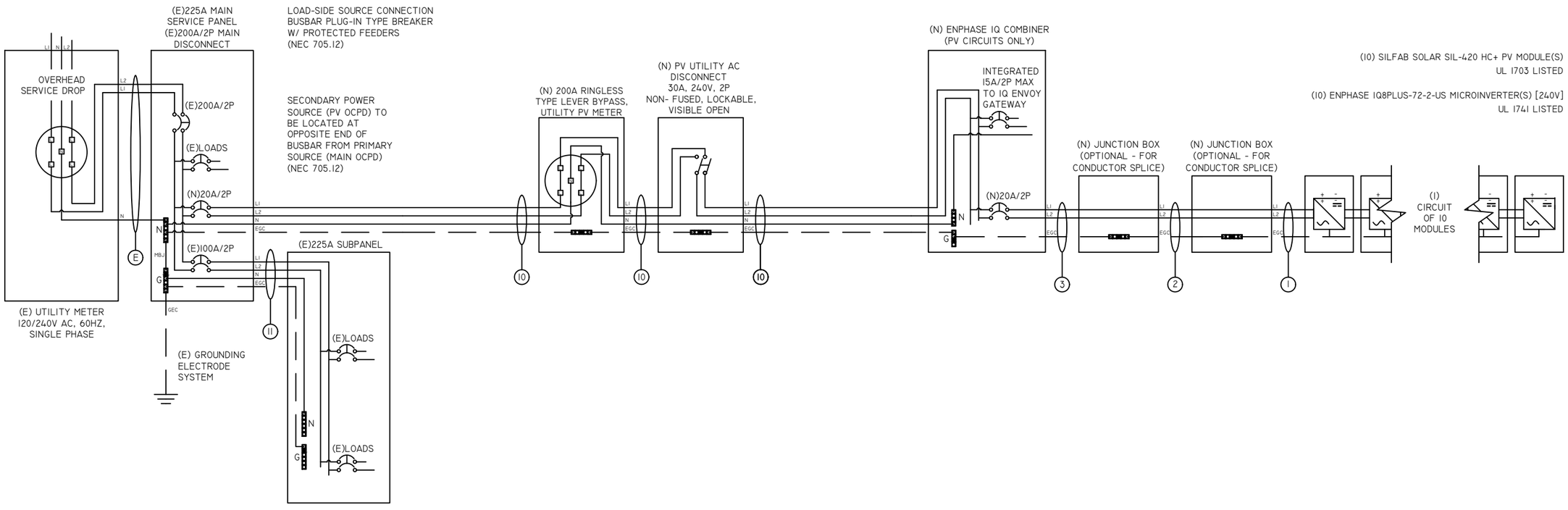
TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V
10	(1)	6 AWG	THHN / THWN-2, CU.	BLACK (L1)	12.1 A AC (MAX)
	(1)	6 AWG	THHN / THWN-2, CU.	RED (L2)	240 V AC
	(1)	6 AWG	THHN / THWN-2, CU.	WHITE (N)	
	(1)	6 AWG	THHN / THWN-2, CU.	GREEN (EGC)	
	(1)	3/4 IN.	EMT	(RACEWAY)	EXTERIOR
11	(E)	2/0 AWG	THHN / THWN, CU.	BLACK (L1)	12.1 A 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

TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V
3	(1)	10 AWG	THHN / THWN-2, CU.	BLACK (L1)	12.1 A AC (MAX)
	(1)	10 AWG	THHN / THWN-2, CU.	RED (L2)	240 V AC
	(1)	10 AWG	THHN / THWN-2, CU.	GREEN (EGC)	
	(1)	3/4 IN.	EMT	(RACEWAY)	EXTERIOR

TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V
2	(1)	10 AWG	2C, NM-B W/G, CU.	(L1, L2, EGC)	12.1 A AC (MAX)
			(CABLE)		240 V AC
					INTERIOR

TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V
1	(1)	12 AWG	2C, TC-ER, CU.	(L1, L2)	12.1 A AC (MAX)
	(1)	6 AWG	SOLID BARE CU.	(EGC)	240 V AC
					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 U4801-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 #	REV
E-6	0

PV SYSTEM ELECTRICAL SPECIFCATIONS 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 VDROP / VRISE	4.00%

PV MODULE SPECIFICATIONS	SILFAB SOLAR SIL-420 HC+
RATED POWER (PMAX) (W)	420
MAXIMUM POWER VOLTAGE (VMP)	39.19
MAXIMUM POWER CURRENT (IMP)	10.72
OPEN CIRCUIT VOLTAGE (VOC)	45.67
SHORT CIRCUIT CURRENT (ISC)	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	ENPHASE IQ8PLUS-72-2-US
TYPE	MICROINVERTER
MAX. OR RECOMMENDED MODULE POWER (W)	440
MAXIMUM INPUT DC OPEN-CIRCUIT VOLTAGE (VOC)	60
MINIMUM START VOLTAGE (V)	30
MAXIMUM START VOLTAGE(V)	58
MAXIMUM INPUT CURRENT (ISC) (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	CIR 1
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
125% 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

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
CONDUCTOR(S) / CABLE(S) CROSS-SECTION AREA (IN.^2) = 0.203 IN.^2
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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PROJECT ID
00CFQV

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

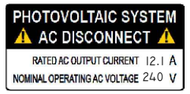
DATE
05-APR-2024

SHEET NAME
ELECTRICAL CALCULATIONS

SHEET # E-7

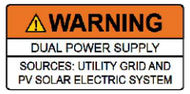
REV 0

ELECTRICAL FIELD-APPLIED HAZARD MARKINGS



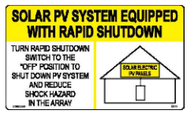
E — AT EACH PV SYSTEM DISCONNECTING MEANS. [NEC 690.54, NEC 690.13(B)]

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]



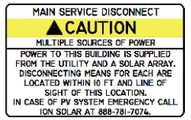
G — AT EQUIPMENT CONTAINING OVERCURRENT DEVICES IN CIRCUTS SUPPLYING POWER TO A BUSBAR OR CONDUCTOR SUPPLIED FROM MULTIPLE SOURCES. [NEC 705.12(C)]

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

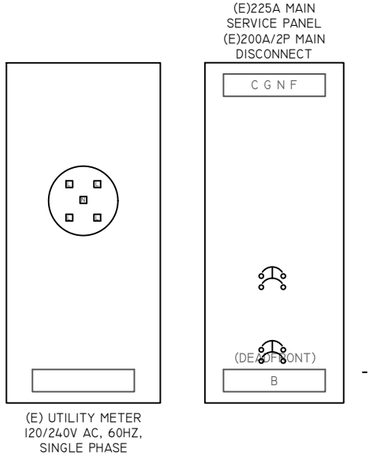


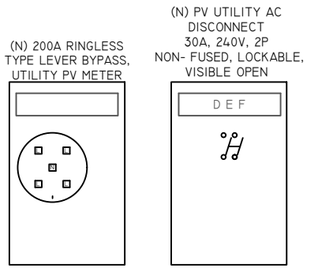
C — SIGN LOCATED ON OR NO MORE THAN 3 FT FROM THE RAPID SHUT DOWN DISCONNECT SWITCH(S). IF MORE THAN ONE PV RSD IS IN AN ENCLOSURE, EACH SHALL BE LABELED. [NEC 690.56(C), NEC 690.12(C)]

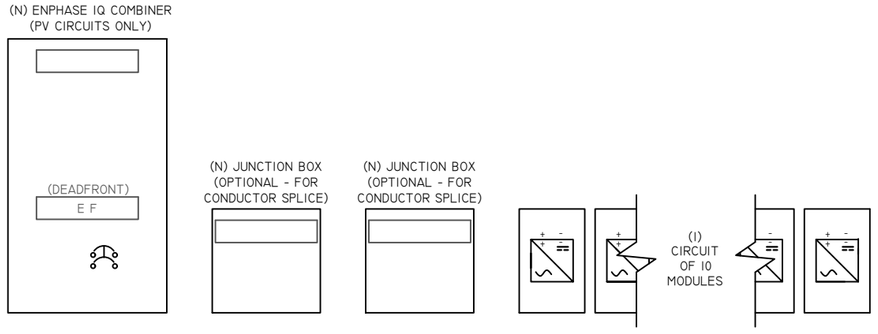
D — FOR RAPID SHUTDOWN SWITCH INITIATION DEVICE LOCATED AT A READILY ACCESSIBLE OUTDOOR LOCATION. [NEC 690.12]



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].







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 SUFFICEINT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.
4. UNLESS OTHERS SPECIFIED MINIMUM TEXT HEIGHT TO BE $\frac{1}{8}$" (3MM).

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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 LABELS
SHEET # / REV	E-9 / 0