AERIAL SITE VIEW

SCOPE OF WORK

INSTALLATION OF UTILITY INTERACTIVE PHOTOVOLTAIC SOLAR SYSTEM

9.03 kW DC & 6.72 kW AC PHOTOVOLTAIC SOLAR ARRAY

PV MODULES: (21) SILFAB SOLAR SIL-430 QD

INVERTER(S): (21) ENPHASE IQ8MC-72-M-US

ROOF TYPE: COMPOSITION SHINGLE - 1 LAYER(S)

PV MOUNTING HARDWARE: UNIRAC NXT

SHEET LIST

JURISDICTION CODES AND STANDARDS

GOVERNING CODES

1. ALL WORK SHALL COMPLY WITH:

2023 OREGON ELECTRICAL SPECIALTY CODE (OESC)

2022 OREGON STRUCTURAL SPECIALTY CODE (OSSC)

2023 OREGON RESIDENTIAL SPECIALTY CODE (ORSC)

2022 OREGON FIRE CODE (IFC)

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. FOR PROJECTS SUBMITTED FOR PRESCRIPTIVE REVIEW, ROOF ATTACHMENTS SHALL BE SPACED NO GREATER THAN 24" ON CENTER IN ANY DIRECTION WHERE LOCATED WITHIN 3' OF A ROOF EDGE, HIP, EAVE, OR RIDGE OSSC 3111.3.5.3 ITEM 5 EXCEPTION 1.2
JUNCTION BOXES UNDER PV ARRAY SHALL BE INSTALLED TO BE CONSIDERED ACCESSIBLE BY OESC 690.34,JUNCTION BOXES UNDER PV ARRAY SHALL BE INSTALLED TO BE CONSIDERED ACCESSIBLE BY OESC 690.34

ELECTRICAL CRITERIA, NOTES

TEMPERATURE SOURCE: ASHRAE

WEATHER STATION: PORTLAND INTL AP

EXTREME MIN. TEMPERATURE: -6

ASHRAE 0.4% HIGH TEMP: 36

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

STRUCTURAL CRITERIA, NOTES

DESIGN LOAD STANDARD: ASCE 7-16

WIND EXPOSURE CATEGORY: C

WIND SPEED (3-SEC GUST): 98 MPH

GROUND SNOW LOAD: 25 PSF

DESIGN ROOF SNOW LOAD: 20 PSF

SEISMIC DESIGN CATEGORY: D

SEISMIC RISK FACTOR: II

TOTAL PV ARRAY DEAD LOAD (PSF) : 3.00

25-003397-REV-01-RS

01/27/2025

REGISTERED PROFESSIONAL ENGINEER
98950PE
OREGON
JAN 11, 2022
ALAN ROWLEY

EXPIRES: 12/31/26

NABCEP BOARD CERTIFIED
PV INSTALLATION PROFESSIONAL
SCOTT A. GURNEY
PVI-011719-015866
EXP. 9-17-2025

ION DEVELOPER LLC
DAVID STANLEY CONRAD
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CI524

ION SOLAR
44 E 800 N
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888.781.7074

PROJECT ID
00ECXD

SITE OWNER
CHRIS J STAMBAUGH

SITE ADDRESS
7234 SOUTHEAST MAIN STREET
PORTLAND, OREGON 97215

EQUIP.
(21) SILFAB SOLAR SIL-430 QD
(21) ENPHASE IQ8MC-72-M-US

SYSTEM SIZE
9.03KW DC
6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
VISHAL SHARMA

DATE
26-JAN-2025

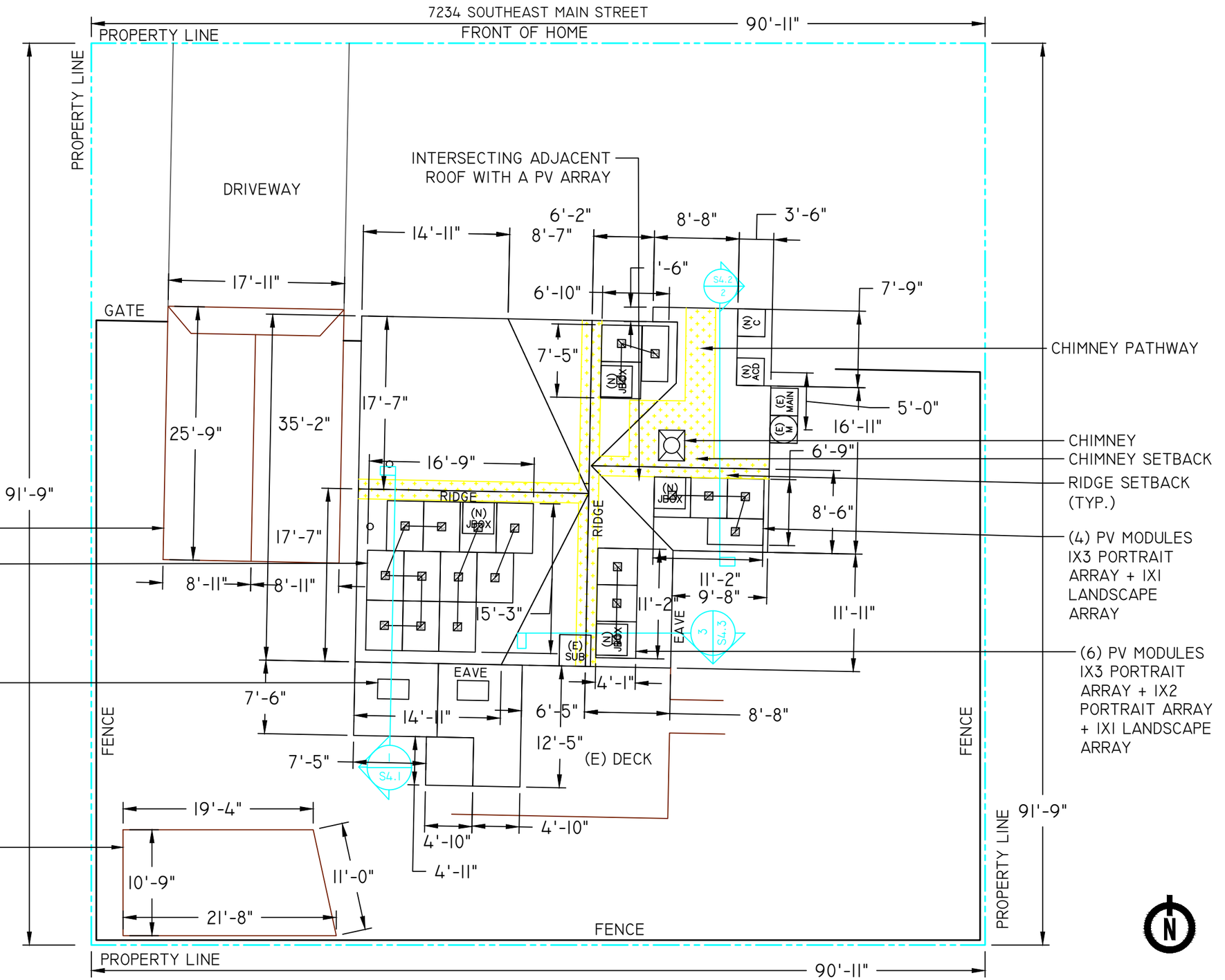
SHEET NAME
COVER SHEET

SHEET #	REV
G-1	A

A

MAIN ROAD

SOUTHEAST MAIN STREET



SCALE: 3/32" = 1'-0"
0' 4' 8' 16' 32'

01/27/2025

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ALAN ROWLEY

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6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
VISHAL SHARMA

DATE
26-JAN-2025

SHEET NAME
SITE PLAN

SHEET # V-2

REV A

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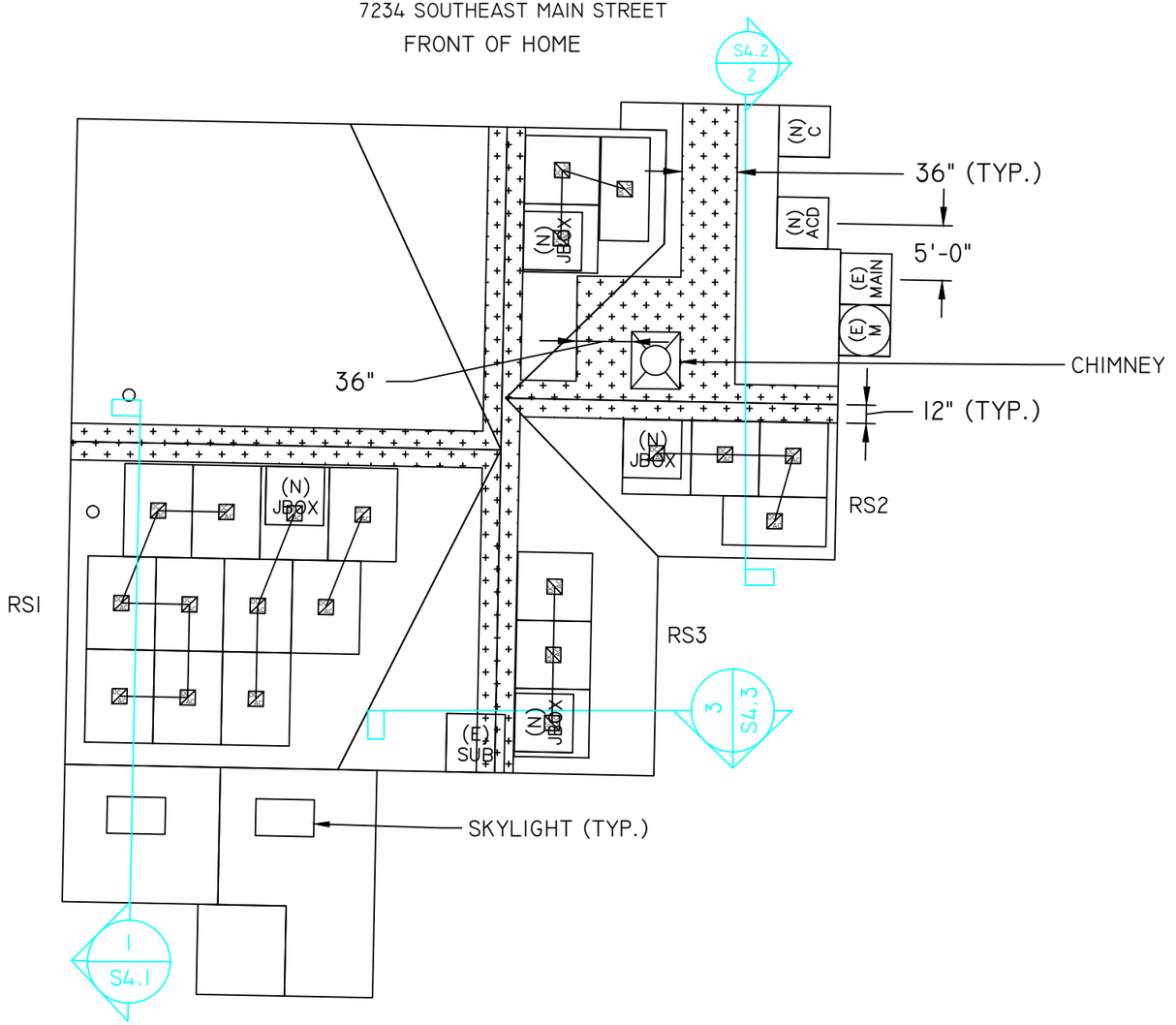
JUNCTION BOXES UNDER PV ARRAY SHALL BE INSTALLED TO BE CONSIDERED ACCESSIBLE BY OESC 690.34,JUNCTION BOXES UNDER PV ARRAY SHALL BE INSTALLED TO BE CONSIDERED ACCESSIBLE BY OESC 690.34

FOR ANY METER UPGRADES, ENSURE THAT THE UTILITY METER IS LOCATED WITHIN 10FT OF THE FRONT/STREET-SIDE OF THE HOUSE. PLEASE ADD A LABEL SHOWING THE DISTANCE FROM THE FRONT CORNER OF THE HOUSE.

7234 SOUTHEAST MAIN STREET

FRONT OF HOME



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

0' 2' 4' 8' 16'

SYSTEM LEGEND

(E) M	(E) UTILITY METER / MAIN SERVICE PANEL	(N) C	(N) PV COMBINER PANEL	(N) JBOX	(N) JUNCTION BOX
(E) MAIN	(E) MAIN SERVICE PANEL	(N) LC	(N) PV LOAD CENTER	(N) ACD	(N) AC DISCONNECT (VISIBLE-OPEN LOCKABLE LABELED DISCONNECT)
(E) SUB	(E) SUBPANEL	(N) PVM	(N) PV PRODUCTION METER	DC/AC	(N) MICROINVERTER
		(N) I	(N) DC-DC / STRING INVERTER	(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
RS1	11	181	26	96%
RS2	4	181	44	95%
RS3	6	91	44	70%

A

N

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SYSTEM SIZE
9.03KW DC
6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
VISHAL SHARMA

DATE
26-Jan-2025

SHEET NAME
ROOF PLAN

SHEET # S-3

REV A

STRUCTURAL INSTALLATION SCHEDULE AND CRITERIA

ROOF MEMBRANE	
ROOF TYPE:	COMPOSITION SHINGLE
ROOF SHEATHING TYPE:	7/16" OSB

ARRAY PARAMETERS	
TOTAL ROOF AREA (SQ. FT.)	2112
TOTAL PV MODULE AREA (SQ. FT.)	441
% PV MODULE ROOF COVERAGE	20.88%

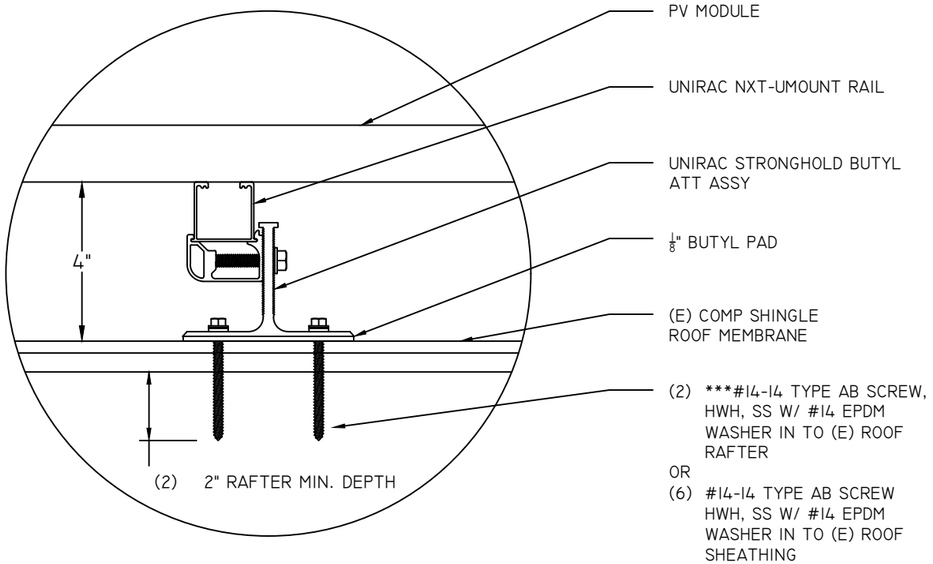
PV RACKING	
RACKING:	UNIRAC NXT
RACKING TYPE:	RAIL
STANDOFF:	UNIRAC STRONGHOLD BUTYL ATT KIT #14S MILL
STANDOFF TYPE:	L-FOOT & BUTYL TAPE MASTIC
FASTENER:	3" #14-14 AB SCREW

SPAN AREA	TAG	SPAN
RAIL - PORTRAIT - MODULE ORIENTATION		
X- SPACING	P-X1	48 IN. O.C. MAX.
X-CANTILEVER	P-X2	15 IN. MAX.
Y- SPACING	P-Y1	40.2 IN. MIN. - 55.9 IN. MAX.
Y-CANTILEVER	P-Y2	6 IN. MIN. - 13.8 IN. MAX.
RAIL - LANDSCAPE - MODULE ORIENTATION		
X- SPACING	L-X1	48 IN. O.C. MAX.
X-CANTILEVER	L-X2	15 IN. MAX.
Y- SPACING	L-Y1	24.9 IN. MIN. - 28.9 IN. MAX.
Y-CANTILEVER	L-Y2	7.9 IN. MIN. - 9.8 IN. MAX.

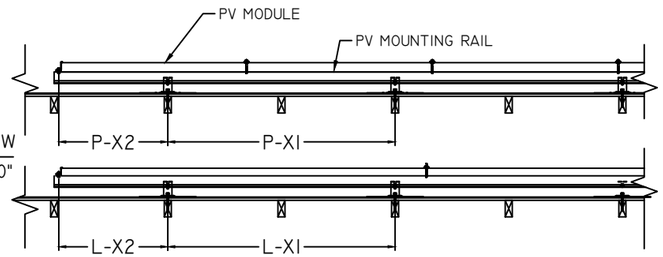
STRUCTURAL FRAMING

ROOF SECTION	*STRUCTURE TYPE*	*RAFTER / TC SIZE (IN)*	*RAFTER / TC SPACING (IN)*	*STRUCTURAL UPGRADE*	*UPGRADE SIZE & LENGTH (FT)*
RS1	VAULTED - CONVENTIONAL FRAMING	2x4	16	NONE - SINGLE PLY (1x)	NONE
RS2	VAULTED - CONVENTIONAL FRAMING	2x4	16	NONE - SINGLE PLY (1x)	NONE
RS3	VAULTED - CONVENTIONAL FRAMING	2x4	16	NONE - SINGLE PLY (1x)	NONE

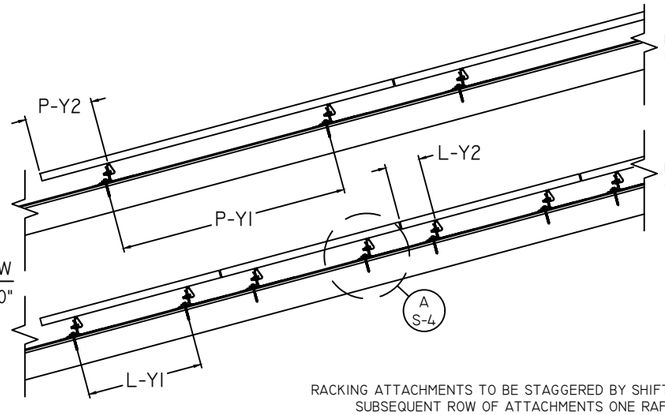
*** ONLY 2 FASTENERS REQUIRED IN TO (E) ROOF RAFTER/TOP CHORD. IF DURING INSTALLATION THE (E) RAFTER/TOP CHORD IS MISSED, CONTINUE TO DRIVE FASTENER UNTIL 2 LAND IN TO THE (E) RAFTER/TOP CHORD. IF ALL MISS, (6) IN (E) SHEATHING ONLY ARE SUFFICIENT AS LONG AS ATTACHMENTS SPAN NO GREATER THAN 24" OC.



A COMP SHINGLE - STRONGHOLD BUTYL ATT KIT - STANDOFF DETAIL
SCALE: 3" = 1'-0"



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.

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ALAN ROWLEY
EXPIRES: 12/31/26

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(21) ENPHASE IQ8MC-72-M-US

SYSTEM SIZE
9.03KW DC
6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
VISHAL SHARMA

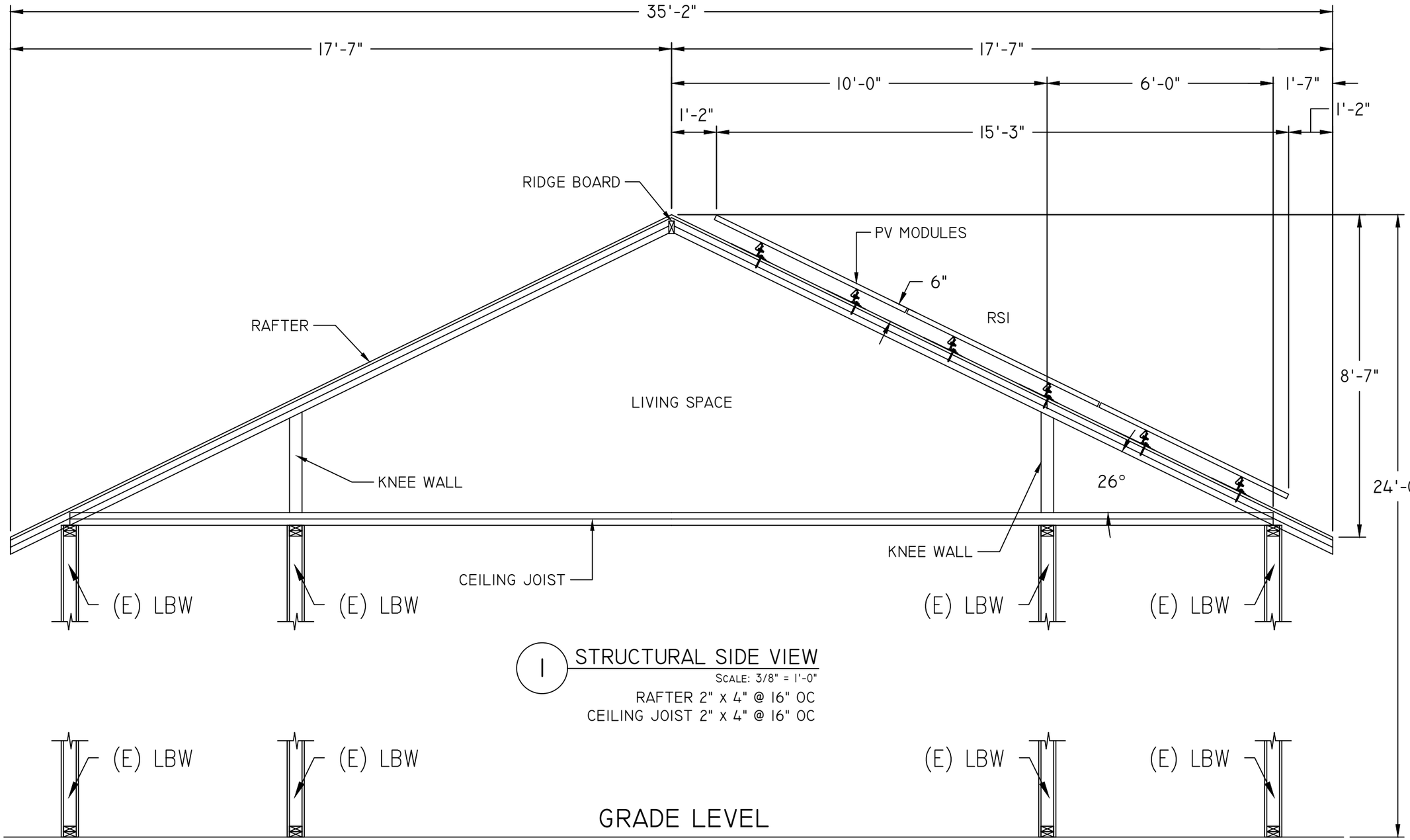
DATE
26-JAN-2025

SHEET NAME
STRUCTURAL DETAILS

SHEET # S-4

REV A

STRUCTURAL SIDE VIEW DETAILS



1 STRUCTURAL SIDE VIEW

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

RAFTER 2" x 4" @ 16" OC
CEILING JOIST 2" x 4" @ 16" OC

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6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
VISHAL SHARMA

DATE
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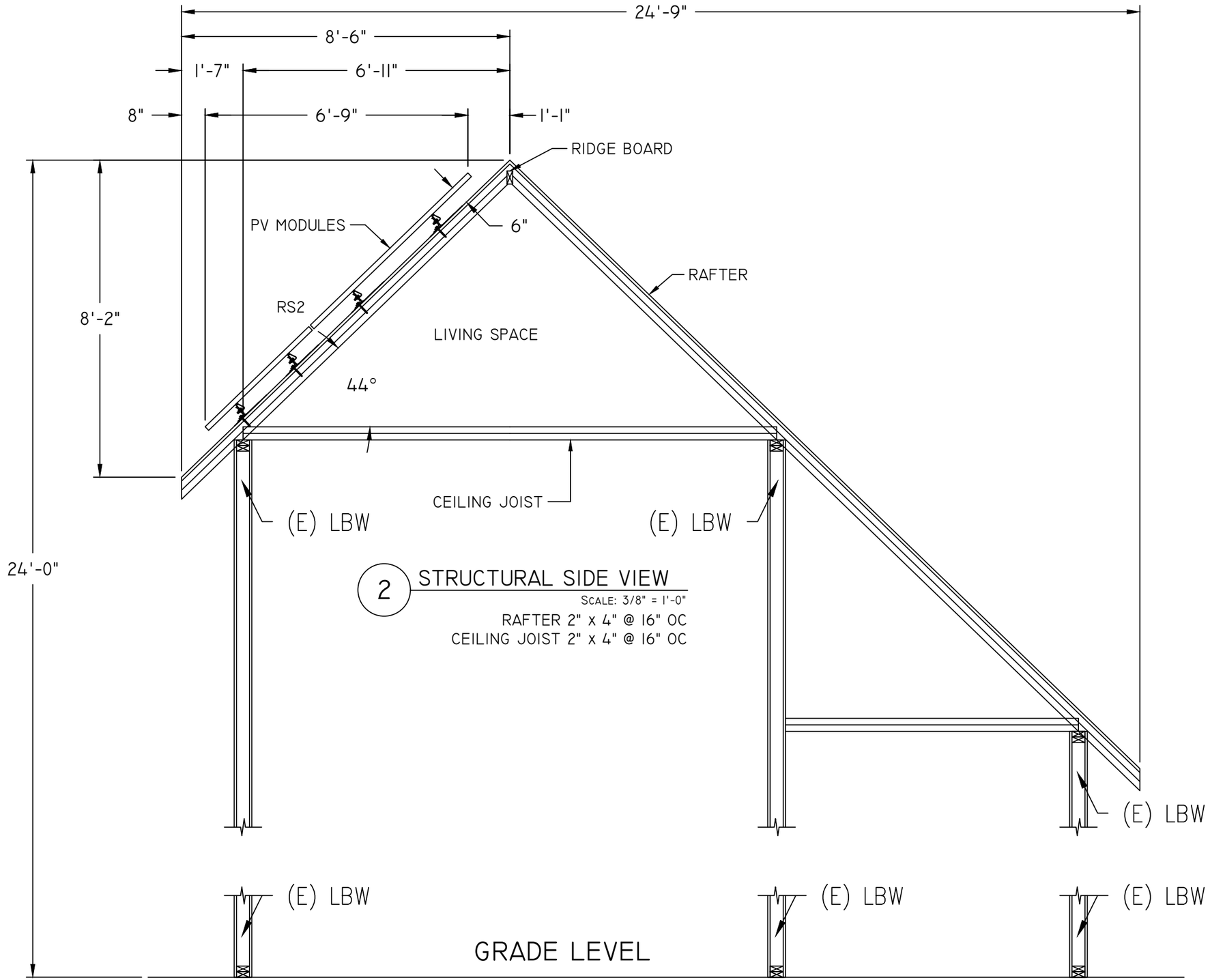
SHEET NAME
STRUCTURAL SIDE VIEW DETAILS

SHEET # S-4.1

REV A

STRUCTURAL SIDE VIEW DETAILS



2 STRUCTURAL SIDE VIEW

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

RAFTER 2" x 4" @ 16" OC

CEILING JOIST 2" x 4" @ 16" OC

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OREGON
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6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
VISHAL SHARMA

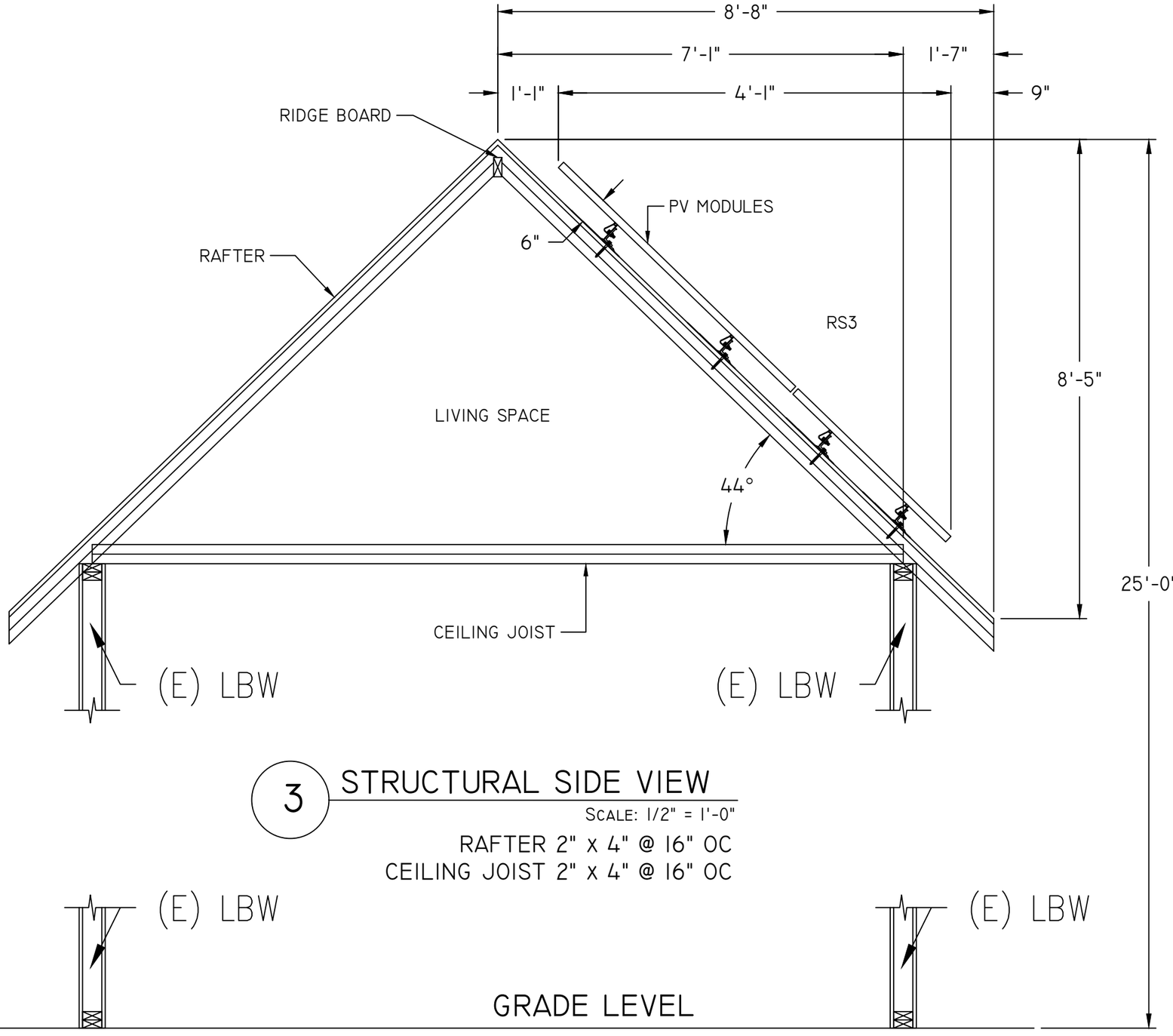
DATE
26-JAN-2025

SHEET NAME
STRUCTURAL SIDE VIEW DETAILS

SHEET # S-4.2

REV A

STRUCTURAL SIDE VIEW DETAILS



3 STRUCTURAL SIDE VIEW

SCALE: 1/2" = 1'-0"

RAFTER 2" x 4" @ 16" OC

CEILING JOIST 2" x 4" @ 16" OC

01/27/2025

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PROJECT DESIGNER
VISHAL SHARMA

DATE
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SHEET NAME
STRUCTURAL SIDE VIEW DETAILS

SHEET # S-4.3

REV A

A

PV SYSTEM STRUCTURAL SPECIFICATIONS AND CALCULATIONS

DESIGN LOCATION AND SITE SPECIFICATIONS

JURISDICTION	CITY OF PORTLAND
STATE	OREGON
ADOPTED LOAD STANDARD	ASCE 7-16
OCCUPANCY / RISK CATEGORY	II
BASIC WIND SPEED (MPH (3-SEC GUST))	98
WIND EXPOSURE CATEGORY	C
GROUND SNOW LOAD (PSF) (Pg)	25
BASE ELEVATION (FT)	64
STRUCTURE TYPE	INHABITED - GABLE / FLAT ROOF
MIN. ROOF SLOPE (DEG.)	26
MEAN ROOF HEIGHT (FT.)	20

RACKING AND ATTACHMENT SPECIFICATIONS

MODULE MANUFACTURER / TYPE	SILFAB SOLAR SIL-430 QD
SOLAR MODULE WEIGHT (LBS)	46.3
SOLAR MODULE LENGTH (IN.)	67.8
SOLAR MODULE WIDTH (IN.)	44.6
SOLAR MODULE AREA (SQ. FT)	21
PV RACKING	UNIRAC NXT
PV RACKING TYPE	RAIL
PV ROOF ATTACHMENT	UNIRAC STRONGHOLD BUTYL ATT KIT #14S MILL
PV ROOF ATTACHMENT FASTENER	(2) 3" #14-14 AB SCREW(S)
MANUFACTURER UPLIFT CAPACITY (LBS)	779
MANUFACTURER LATERAL CAPACITY (LBS)	320
PORTRAIT ATT. SPACING (IN. O.C.)	48
LANDSCAPE ATT. SPACING (IN. O.C.)	48
MAX PORTRAIT RAIL CANTILEVER SPACING (IN. O.C.)	15
MAX LANDSCAPE RAIL CANTILEVER SPACING (IN. O.C.)	15
# OF ATTACHMENT POINTS	78
RACKING DEAD LOAD (PSF)	0.8
SOLAR MODULE DEAD LOAD (PSF)	2.20
TOTAL PV ARRAY DEAD LOAD (PSF)	3.00
MAX. ROOF POINT DEAD LOAD (PSF)	34.0

DESIGNED VELOCITY PRESSURE CALCULATIONS — ASCE 7-16 (C&C)

VELOCITY PRESSURE (PSF) = QH = 0.00256(KH)(KZT)(KD)(KE)(V^2)		EQN. 26.10-1
TERRAIN EXPO. CONSTANT (α) =	9.5	TABLE 26.11-1
TERRAIN EXPO. CONSTANT (Zg)(FT) =	900	TABLE 26.11-1
VP EXPOSURE COEFFICIENT (KH) =	0.90	TABLE 26.10-1
TOPOGRAPHIC FACTOR (KZT) =	1.0	EQN. 26.8-1
WIND DIRECTIONALITY FACTOR (KD) =	0.9	TABLE 26.6-1
GROUND ELEVATION FACTOR (KE) =	1.0	TABLE 26.9-1
QH (PSF) =	18.8	

DESIGNED ROOF SNOW LOAD CALCULATIONS — ASCE 7-16

SLOPED ROOF SNOW LOAD (PSF)

GROUND SNOW LOAD (PSF) (Pg) = 25.0

NO PV - WARM NON SLIPPERY SURFACE

JURISDICTION MINIMUM ROOF SNOW LOAD (PSF) = 20

PV - COLD SLIPPERY SURFACE

JURISDICTION MINIMUM ROOF SNOW LOAD (PSF) = 20

RACKING - ATTACHMENT AND FASTENER, CONNECTION ZONE WIND PRESSURE AND POINT LOAD

GABLE ROOF 20° < Ø ≤ 27° — FIGURE 30.3-2C

DESIGN WIND PRESSURE (PSF) = W = qh(GCp)(ye)(ya) — EQN. 26.10-1

ARRAY EDGE FACTOR (ye) = 1 — EQN. 29.4-7

	ZONE 1	UPLIFT ZONE 2R	ZONE 2E	COMPRESSION ALL ZONES	LATERAL ALL ZONES
RAIL - PORTRAIT MODULE ORIENTATION	*48 IN. O.C.*	*48 IN. O.C.*	*48 IN. O.C.*	*48 IN. O.C.*	*48 IN. O.C.*
SOLAR PANEL PRESSURE EQ. FACTOR (ya) =	0.80	0.80	0.80	0.80	0.80
EXTERNAL PRESSURE COEFF. (GCp) =	-1.4	-2.5	-3.6	0.5	-3.6
ASD PRESSURE (W)(PSF) =	-21.11	-37.70	-54.28	7.84	23.80
PV DEAD LOAD (D) =	3.00	3.00	3.00	3.00	0.00
SNOW OR LIVE LOAD (S OR L)(PSF) =	0.00	0.00	0.00	20.00	20.00
MAX. TRIBUTARY AREA (SQ. FT) =	11.3	11.3	8.5	11.3	11.3
GOV. LOAD COMBINATION (2.4.1) =	0.6D+0.6W	0.6D+0.6W	0.6D+0.6W	D+0.45W+0.75S	D+0.75L+0.45W
MAX. LOAD (LBS) =	-122.8	-235.2	-260.7	222.7	136.0
RAIL - LANDSCAPE MODULE ORIENTATION	*48 IN. O.C.*	*48 IN. O.C.*	*48 IN. O.C.*	*48 IN. O.C.*	*48 IN. O.C.*
SOLAR PANEL PRESSURE EQ. FACTOR (ya) =	0.80	0.80	0.80	0.80	0.80
EXTERNAL PRESSURE COEFF. (GCp) =	-1.4	-2.5	-3.6	0.7	-3.6
ASD PRESSURE (0.6P)(PSF) =	-21.11	-37.70	-54.28	10.55	23.80
PV DEAD LOAD (D) =	3.00	3.00	3.00	3.00	0.00
SNOW OR LIVE LOAD (S OR L)(PSF) =	0.00	0.00	0.00	20.00	20.00
TRIBUTARY AREA (SQ. FT) =	7.43	7.43	5.58	7.43	7.43
GOV. LOAD COMBINATION (2.4.1) =	0.6D+0.6W	0.6D+0.6W	0.6D+0.6W	D+0.45W+0.75S	D+0.75L+0.45W
MAX. LOAD (LBS) =	-80.7	-154.7	-171.5	155.6	94.6

RACKING - ATTACHMENT AND FASTENER, CAPACITY / DEMAND CHECK — NDS 12.2

UNIRAC STRONGHOLD BUTYL ATT KIT #14S MILL - (2) 3" #14-14 AB SCREW(S)

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

ROOF ATTACHMENT FASTENER (D) (IN.) =	6/25	TABLE 2.3.2
FASTENER QTY PER ATTACHMENT =	2	TABLE 12.3.3A
FASTENER EMBEDMENT DEPTH (IN.) =	2.0	
LUMBER SPECIFIC GRAVITY (G) =	0.5	
LOAD DURATION FACTOR (CD) =	1.6	
PRYING COEFFICIENT =	1.4	
WITHDRAWAL DESIGN VALUE(W)(LBS / IN.) =	218.2	
LAG SCREW WITHDRAWL CAPACITY (LBS) =	997.6	

	UPLIFT	LATERAL
MANUFACTURER MAX. CAPACITY (LBS) =	779.0	320.0
MAX. LAG SCREW CAPACITY (LBS) =	997.6	
MAX. ATT. WITHDRAWL DEMAND (LBS) =	260.7	136.1
	OK	OK

RACKING - RAIL, SPAN AND CANTILEVER CHECK - ALL ZONES

UNIRAC NXT

MAX. HORIZONTAL RAIL SPAN (L)(FT.) =	4.0		
MAX. VERTICAL SPACING BETWEEN RAILS (FT.) =	4.7		
MAX. RAIL CANTILEVER SPAN (A)(X)(FT.) =	1.3		
	COMPRESSION	UPLIFT	LATERAL
GOV. LOAD COMBINATION (2.4.1) =	D+0.45W+0.75S	0.6D+0.6W	D+0.6W
TOTAL LOAD (PSF) =	26.3	9.5	11.3
TOTAL LINEAR LOAD (W)(LB. / FT.) =	67.3	26.9	14.0
RAIL - SPAN CHECK			(WL^2)/8
ALLOWABLE MANU. BENDING MOMENT (LB. / FT.) =	223	331	264
ACTUAL MAX. BENDING MOMENT (LB / FT.) =	134.5	53.7	28.0
			(W)(L)^4 / 185(E)(I)
ALLOWABLE DEFLECTION (IN.) =	0.80	0.80	0.80
ACTUAL MAX DEFLECTION (IN.) =	0.11	0.04	0.02
	OK	OK	OK
RAIL - CANTILEVER CHECK			
OVERHANG			(w/2)(a-x)^2
ALLOWABLE MANU. BENDING MOMENT (LB. / FT.) =	223	331	264
ACTUAL MAX BENDING MOMENT (LB / FT.) =	52.5	21.0	10.9
			(wx/24EI)(4La^2-L^3+6xa^2-4ax^2+x^3)
ALLOWABLE MANU. DEFLECTION (L/60)(IN.) =	0.25	0.25	0.25
ACTUAL MAX DEFLECTION (IN.) =	0.03	0.01	0.01
SPAN REACTION			(w/8L^2)(L+A)^2(L-A)^2
ALLOWABLE MANU. BENDING MOMENT (LB. / FT.) =	331	223	264
ACTUAL MAX BENDING MOMENT (LB / FT.) =	109.5	43.7	22.8
			(wx/24EIL)(L^4-2L^2x^2+Lx^3-2a^2L^2+2a^2x^2)
ALLOWABLE MANU. DEFLECTION (L/60)(IN.) =	0.80	0.80	0.80
ACTUAL MAX DEFLECTION (IN.) =	0.01	0.00	0.00
ATTACHMENT / CONNECTION REACTION			(w/2L)(L+A)^2
UPLIFT CAPACITY (LBS) =	779.0	779.0	779.0
ACTUAL MAX REACTION UPLIFT FORCE (LBS) =	231.7	92.5	48.3
	OK	OK	OK

RACKING - MODULE CLAMPS CAPACITY / DEMAND CHECK

MID CLAMP: UNIRAC NXT UMOUNT COMBO CLAMP - DARK

END CLAMP: UNIRAC NXT UMOUNT COMBO CLAMP - DARK

	UPLIFT	SLIDING	LATERAL
MANUFACTURER MAX. CAPACITY (LBS) =	1820.0	652.0	398.0
MAX. CLAMP WITHDRAWL DEMAND (LBS) =	260.7	136.1	136.1
	OK	OK	OK

01/27/2025

REGISTERED PROFESSIONAL ENGINEER
98950PE
OREGON
JAN 11, 2022
ALAN ROWLEY

EXPIRES: 12/31/26

NABCEP BOARD CERTIFIED
PV INSTALLATION PROFESSIONAL
SCOTT A. GURNEY
PVI-011710-015BSG
EXP. 9-17-2025

ION DEVELOPER LLC
DAVID STANLEY CONRAD
C - ELECTRICAL CONTRACTOR
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PROJECT ID
00ECXD

SITE OWNER
CHRIS J STAMBAUGH

SITE ADDRESS
7234 SOUTHEAST MAIN STREET
PORTLAND, OREGON 97215

EQUIP.
(21) SILFAB SOLAR SIL-430 QD
(21) ENPHASE IQ8MC-72-M-US

SYSTEM SIZE
9.03KW DC
6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
A
VISHAL SHARMA

DATE
26-JAN-2025

SHEET NAME
STRUCTURAL CALCULATIONS 1

SHEET # S-5

REV A

PV SYSTEM STRUCTURAL SPECIFICATIONS AND CALCULATIONS

GRAVITY LOAD / FRAMING CALCULATIONS

DEAD LOAD (PSF)	RS1		RS2		RS3	
ROOF MEMBRANE	COMPOSITION SHINGLE	4.0	COMPOSITION SHINGLE	4.0	COMPOSITION SHINGLE	4.0
SHEATHING	7/16" OSB	1.7	7/16" OSB	1.7	7/16" OSB	1.7
PITCH (DEG)	26		44		44	
FRAMING	VAULTED - CONVENTIONAL FRAMING - NONE - SINGLE PLY (IX) - RAFTER 2X4 @ 16 IN. O.C. - DF #2 @ 10 FT. MAX SPAN	4.4	VAULTED - CONVENTIONAL FRAMING - NONE - SINGLE PLY (IX) - RAFTER 2X4 @ 16 IN. O.C. - DF #2 @ 7 FT. MAX SPAN	4.4	VAULTED - CONVENTIONAL FRAMING - NONE - SINGLE PLY (IX) - RAFTER 2X4 @ 16 IN. O.C. - DF #2 @ 7.2 FT. MAX SPAN	4.4
PV ARRAY	3.0		3.0		3.0	
TOTAL ROOF DEAD LOAD	13.1		13.1		13.1	
ADJUSTED TO SLOPED ROOF	14.7		18.2		18.2	
ROOF SNOW LOAD	20.0		20.0		20.0	
LIVE LOAD (PSF)	0.0		0.0		0.0	
TOTAL GREATEST LIVE OR PV LOAD (PSF)	34.7		38.2		38.2	
IBC 1607.14.4.1						

RAFTER / TOP CHORD MEMBER PROPERITES	DF #2 - 2x4 - NONE - SINGLE PLY (Ix)	DF #2 - 2x4 - NONE - SINGLE PLY (Ix)	DF #2 - 2x4 - NONE - SINGLE PLY (Ix)
SECTION MODULUS (S)(IN^3)	3.06	3.06	3.06
MOMENT OF INERTIA (I)(IN^4)	5.36	5.36	5.36
TOTAL LOAD ON MEMBER (W) (PLF)	46.2	50.9	50.9
MEMBER SPAN 1 (L) (FT)	10.0	7.0	7.2
MEMBER SPAN 2 (K) (FT)	6.2	0	0
MIN. EAVE SPAN (V) (FT)	1.58	1.58	1.58
MODULUS OF ELASTICITY (E) (PSI)	1600000	1600000	1600000
SHEAR (Fv) (PSI)	180	180	180
AREA (A) (IN^2)	5.25	5.25	5.25

MAX BENDING STRESS CHECK	(Fb)(Cd)(Cf)(Cr)	(Fb)(Cd)(Cf)(Cr)	(Fb)(Cd)(Cf)(Cr)
BENDING (Fb) (PSI)	900	900	900
LOAD DURATION FACTOR (Cd)	1.15	1.15	1.15
SIZE FACTOR (Cf)	1.50	1.50	1.50
REPETITIVE MEMBER FACTOR (Cr)	1.15	1.15	1.15
ALLOWABLE BENDING MOMENT (FT-LBS)	455.6	455.6	455.6
	((WL^3)+(WK^3))/8(S)(L+K)	(W/8L^2)((L+V)^2)((L-V)^2)/(S)	(W/8L^2)((L+V)^2)((L-V)^2)/(S)
ACTUAL MAX BENDING MOMENT (FT-LBS)	441.6	312.0	330.0
	97% OK	68% OK	72% OK

MAX DEFLECTION CHECK - TOTAL LOAD	UNIFORM DISTRIBUTED L / 180		UNIFORM DISTRIBUTED L / 180		UNIFORM DISTRIBUTED L / 180	
ALLOWABLE DEFLECTION	0.667	IN.	0.467	IN.	0.480	IN.
ACTUAL MAX DEFLECTION	0.503	IN.	0.133	IN.	0.149	IN.
(W)(L)^4 / 185(E)(I)	76%	OK	29%	OK	31%	OK

MAX DEFLECTION CHECK - LIVE LOAD	L / 240		L / 240		L / 240	
ALLOWABLE DEFLECTION	0.500	IN.	0.350	IN.	0.360	IN.
ACTUAL MAX DEFLECTION	0.290	IN.	0.070	IN.	0.078	IN.
(W)(L)^4 / 185(E)(I)	58%	OK	20%	OK	22%	OK

MAX SHEAR CHECK						
ALLOWABLE SHEAR = Fv (A)	945	LBS.	945	LBS.	945	LBS.
ACTUAL MAX SHEAR = (w)(L)/2	231	LBS.	178	LBS.	183	LBS.

City of Portland
Reviewed for
Code Compliance
Date: 2/7/2025
Permit #: 25-003397-REV-01-RS

01/27/2025

REGISTERED PROFESSIONAL ENGINEER
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OREGON
JAN 11, 2022
ALAN ROWLEY

EXPIRES: 12/31/26

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SITE OWNER
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PORTLAND, OREGON 97215

EQUIP.
(21) SILFAB SOLAR SIL-430 QD
(21) ENPHASE IQ8MC-72-M-US

SYSTEM SIZE
9.03KW DC
6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
VISHAL SHARMA

DATE
26-JAN-2025

SHEET NAME
STRUCTURAL CALCULATIONS 2

SHEET # S-6

REV A

CONDUCTOR AND RACEWAY SCHEDULE

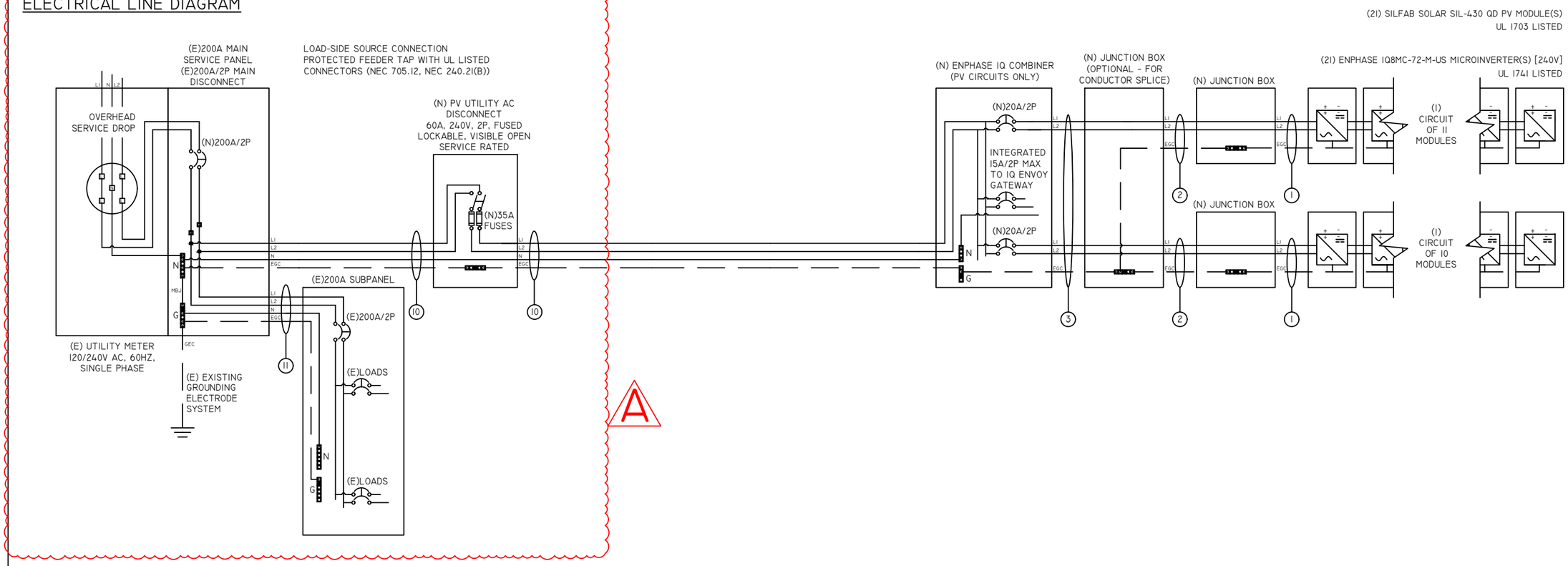
TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V
10	(1)	6 AWG	THHN / THWN-2, CU.	BLACK (L1)	27.9 A AC (MAX)
	(1)	6 AWG	THHN / THWN-2, CU.	RED (L2)	240 V AC
	(1)	6 AWG	THHN / THWN-2, CU.	WHITE (N)	
	(1)	6 AWG	THHN / THWN-2, CU.	GREEN (EGC)	
	(1)	3/4 IN.	EMT	(RACEWAY)	EXTERIOR
11	(E)	3/0 AWG	3C, SE-R W/G, CU. (CABLE)	(L1, L2, N, EGC)	27.9 A AC (MAX) 240 V AC INTERIOR

TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V

TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V

TAG	QTY	SIZE - #	TYPE	DESIGNATOR	I / V
1	(1)	12 AWG	2C, TC-ER, CU.	(L1), (L2)	14.6 A AC (MAX)
	(1)	6 AWG	SOLID BARE CU.	(EGC)	240.0 V AC
					EXTERIOR
2	(1)	12 AWG	THHN / THWN-2, CU.	BLACK (L1)	14.6 A AC (MAX)
	(1)	12 AWG	THHN / THWN-2, CU.	RED (L2)	240.0 V AC
	(1)	10 AWG	THHN / THWN-2, CU.	GREEN (EGC)	
	(1)	3/4 IN.	EMT	RACEWAY	
					EXTERIOR
3	(2)	12 AWG	THHN / THWN-2, CU.	BLACK (L1)	14.6 A AC (MAX)
	(2)	12 AWG	THHN / THWN-2, CU.	RED (L2)	240.0 V AC
	(1)	12 AWG	THHN / THWN-2, CU.	GREEN (EGC)	
	(1)	3/4 IN.	EMT	(RACEWAY)	
					EXTERIOR

ELECTRICAL LINE DIAGRAM



NABCEP CERTIFIED
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PROJECT ID
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SITE OWNER
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SITE ADDRESS
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EQUIP.
(21) SILFAB SOLAR SIL-430 QD
(21) ENPHASE IQ8MC-72-M-US

SYSTEM SIZE
9.03KW DC
6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
A
VISHAL SHARMA

DATE
26-JAN-2025

SHEET NAME
ELECTRICAL LINE DIAGRAM

SHEET # E-7

REV A

PV SYSTEM ELECTRICAL SPECIFCATIONS AND CALCULATIONS

DESIGN LOCATION AND TEMPERATURES	
TEMPERATURE DATA SOURCE	ASHRAE
STATE	OREGON
JURISDICTION	CITY OF PORTLAND
WEATHER STATION	PORTLAND INTL AP
ASHRAE EXTREME LOW TEMP (°C)	-6
ASHRAE 0.4% HIGH TEMP (°C)	36
DESIGNED MAX. SYSTEM VDROP / VRISE	4.00%

PV MODULE SPECIFICATIONS	SILFAB SOLAR SIL-430 QD
RATED POWER (PMAX) (W DC)	430
MAXIMUM POWER VOLTAGE (VMP DC)	33.25
MAXIMUM POWER CURRENT (IMP DC)	12.93
OPEN CIRCUIT VOLTAGE (VOC DC)	38.91
SHORT CIRCUIT CURRENT (ISC DC)	13.87
PMP/VMP TEMP. COEFFICIENT	-0.29
VOC TEMP. COEFFICIENT	-0.24
SERIES FUSE RATING (A DC)	25
ADJ. MODULE VOC @ ASHRAE LOW TEMP (°C)	41.8
ADJ. MODULE VMP @ ASHRAE 2% AVG. HIGH TEMP (°C)	29.1

INVERTER(S) SPECIFICATIONS	ENPHASE IQ8MC-72-M-US
TYPE	MICROINVERTER
MAX. OR RECOMMENDED MODULE POWER (W)	460
MAXIMUM INPUT DC OPEN-CIRCUIT VOLTAGE (VOC)	60
MINIMUM START VOLTAGE (V)	22
MAXIMUM DC START VOLTAGE(V)	58
MAXIMUM INPUT CURRENT (ISC) (A)	20
MAX CONTINUOUS OUTPUT POWER (VA)	320
MAX. CONTINUOUS OUTPUT CURRENT (A)	1.33
NOMINAL (L-L) OUTPUT VOLTAGE	240
CEC WEIGHTED EFFICIENCY (%)	97.0%

SYSTEM ELECTRICAL SPECIFICATIONS	CIR 1	CIR 2
NUMBER OF MODULES PER CIRCUIT	11	10
DC POWER RATING PER CIRCUIT (STC)(W DC)	4730	4300
TOTAL MODULE QUANTITY	21 PV MODULES	
STC DC POWER RATING OF ARRAY	9030W DC	
INVERTER OUTPUT CIRCUIT CURRENT(A AC)	14.63	13.3
125% INVERTER OUTPUT CIRCUIT CURRENT(A AC)	18.29	16.63
CIRCUIT OCPD RATING (A)	20	20
COMBINED INV. CONT. OUTPUT CURRENT x 125% (A AC)	35.0	
PV POWER PRODUCTION SYSTEM OCPD RATING (A)	35	
MAX. ARRAY STC-AC POWER (W)	6720	
MAX. ARRAY CEC-AC POWER (W)	8266	

AC VOLTAGE RISE CALCULATIONS	DIST (FT)	COND.	VRISE(V)	VEND(V)	%VRISE	
VRISE SEC. 1 (MICRO TO JBOX) *	28.8	12 Cu.	1.7	241.7	0.70%	
VRISE SEC. 2 (JBOX TO COMBINER BOX)	65	12 Cu.	3.8	243.8	1.58%	
VRISE SEC. 3 (COMBINER BOX TO POI)	16	8 Cu.	0.7	240.7	0.29%	
TOTAL VRISE			6.2	246.2	2.58%	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 = 14.6 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% = 18.3 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) = 18.3 < 27.3
(B)(1) - W/OUT CORRECTION FACTORS
LARGER AMPACITY COMPLIANCE = 30.0 > 18.3 OK

RACEWAY SIZE / TYPE = 1 1/4 IN. EMT OR NO RACEWAY
CONDUCTOR(S) / CABLE(S) CROSS-SECTION AREA (IN.^2) = 0.311 IN.2
CROSS-SECTIONAL AREA OF RACEWAY(IN.^2) = 1.496 IN.2
% ALLOWABLE RACEWAY FILL (NEC CH. 9, TBL 1) = 40% > 21% OK

JUNCTION BOX TO JUNCTION BOX (2)

MAX INVERTER OUTPUT CIRCUIT CURRENT = 14.6 A AC
CONDUCTOR SIZE / INSULATION / TYPE = 12 AWG THHN / THWN-2, CU.
CONDUCTOR AMP. RATING @75°C = 25 A

PER NEC 690.8(B)(1)(W/OUT CORRECTION FACTORS)
MAX INVERTER OUTPUT CURRENT X125% = 18.3 A AC

PER NEC 690.8(B)(2)(WITH CORRECTION FACTORS)
AMB. TEMP. AMP. CORRECTION = 0.88
OF CONDUCTORS IN RACEWAY CORRECTION = 0.8
ADJUSTED CONDUCTOR AMPACITY (A) = 17.6 A AC

LARGER AMPACITY OF 690.8(B)(1) OR (B)(2) = 18.3 > 17.6
(B)(2) - WITH CORRECTION FACTORS
LARGER AMPACITY COMPLIANCE = 17.6 > 14.6 OK

RACEWAY SIZE / TYPE = 3/4 IN. EMT
CONDUCTOR(S) / CABLE(S) CROSS-SECTION AREA (IN.^2) = 0.040 IN.^2
CROSS-SECTIONAL AREA OF RACEWAY(IN.^2) = 0.533 IN.^2
% ALLOWABLE RACEWAY FILL (NEC CH. 9, TBL 1) = 40% > 7% OK

JUNCTION BOX TO COMBINER BOX (3)

MAX INVERTER OUTPUT CIRCUIT CURRENT = 14.6 A AC
CONDUCTOR SIZE / INSULATION / TYPE = 12 AWG THHN / THWN-2, CU.
CONDUCTOR AMP. RATING @75°C = 25 A

PER NEC 690.8(B)(1)(W/OUT CORRECTION FACTORS)
MAX INVERTER OUTPUT CURRENT X125% = 18.0 A AC

PER NEC 690.8(B)(2)(WITH CORRECTION FACTORS)
AMB. TEMP. AMP. CORRECTION = 0.88
OF CONDUCTORS IN RACEWAY CORRECTION = 0.8
ADJUSTED CONDUCTOR AMPACITY (A) = 17.6 A AC

LARGER AMPACITY OF 690.8(B)(1) OR (B)(2) = 18.0 > 17.6
(B)(2) - WITH CORRECTION FACTORS
LARGER AMPACITY COMPLIANCE = 17.6 > 14.6 OK

RACEWAY SIZE / TYPE = 3/4 IN. EMT
CONDUCTOR(S) / CABLE(S) CROSS-SECTION AREA (IN.^2) = 0.067 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 = 27.9 A AC
CONDUCTOR SIZE / INSULATION / TYPE = 8 AWG THHN / THWN-2, CU.
CONDUCTOR AMP. RATING @75°C = 50 A

PER NEC 690.8(B)(1)(W/OUT CORRECTION FACTORS)
MAX COMBINED INVERTER CONT. OUTPUT CURRENT X125% = 35.0 A AC

PER NEC 690.8(B)(2)(WITH CORRECTION FACTORS)
AMB. TEMP. AMP. CORRECTION = 0.88
OF CONDUCTORS IN RACEWAY CORRECTION = 1.0
ADJUSTED CONDUCTOR AMPACITY (A) = 44.0 A AC

LARGER AMPACITY OF 690.8(B)(1) OR (B)(2) = 35.0 < 44.0
(B)(1) - W/OUT CORRECTION FACTORS
LARGER AMPACITY COMPLIANCE = 50.0 > 35.0 OK

RACEWAY SIZE / TYPE = 3/4 IN. EMT
CONDUCTOR(S) / CABLE(S) CROSS-SECTION AREA (IN.^2) = 0.146 IN.^2
CROSS-SECTIONAL AREA OF RACEWAY(IN.^2) = 0.533 IN.^2
% ALLOWABLE RACEWAY FILL (NEC CH. 9, TBL 1) = 40% > 27% OK

A

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9.03KW DC
6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
VISHAL SHARMA

DATE
26-JAN-2025

SHEET NAME
ELECTRICAL CALCULATIONS

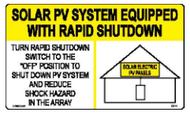
SHEET # E-8

REV A

ELECTRICAL FIELD-APPLIED HAZARD MARKINGS

A — FOR EACH PV DISCONNECTING MEANS WHERE ALL TERMINALS OF THE DISCONNECTING MEANS MAY BE ENERGIZED IN THE OPEN POSITION.
[OESC 690.13(B), OESC 690.56, OESC 705.20]

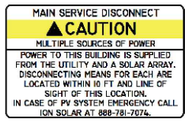
B — PLACED ADJACENT TO PV SYSTEM PLUG-IN TYPE BREAKER TO A BUSBAR FOR A LOAD SIDE CONNECTION.
[OESC 705.12(B)(2)]



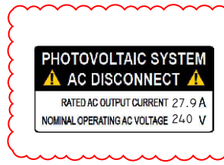
C — FOR ELECTRICAL SERVICES CONNECTED TO PV SYSTEM. SIGN TO BE LOCATED AT EACH SERVICE EQUIPMENT LOCATION.
[OESC 690.12]

D — FOR RAPID SHUTDOWN SWITCH INITIATION DEVICE LOCATED AT A READILY ACCESSIBLE OUTDOOR LOCATION. CAN BE THE SYSTEM PLUG-IN TYPE BREAKER OR A SAFETY SWITCH.
[OESC 690.12]

H — FOR WIRING METHODS CONTAINING DC PV CIRUCITS (NOT TO BE CONFUSED WITH AC PV CIRCUITS). TO BE PLACED ON JUNCTION BOXES AND ALONG RACEWAYS NO GREATER THAN 10 FT. [NEC 690.12]

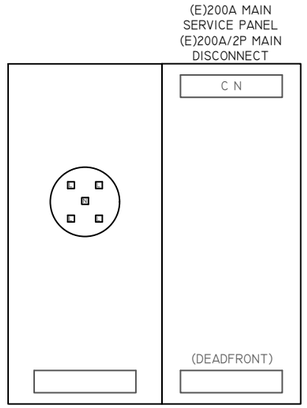


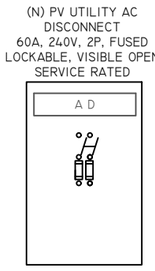
N — PERMANENT DIRECTORY TO BE LOCATED AT MAIN SERVICE EQUIPMENT LOCATION IF ALL ELECTRICAL POWER SOURCE DISCONNECTING MEANS (SOLAR ARRAY RAPID SHUTDOWN SWITCH) ARE GROUPED AND IN LINE OF SITE OF MAIN SERVICE DISCONNECTING MEANS.
[OESC 690.56 & OESC 705.10].

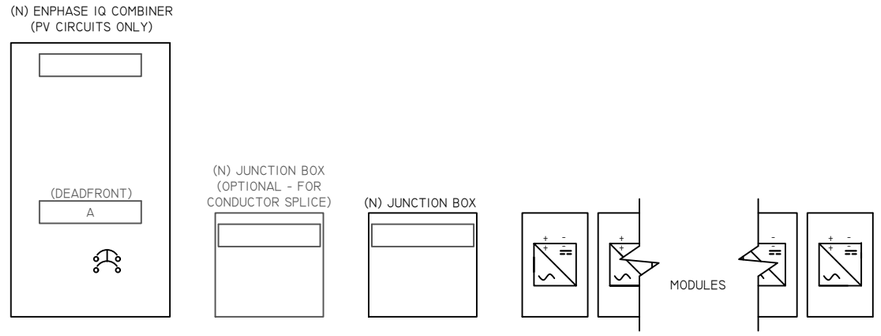


T — AT EACH PV SYSTEM DISCONNECTING MEANS.
[UTILITY SPECIFIC LABEL]

A







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).

NABCEP BOARD CERTIFIED
PV INSTALLATION PROFESSIONAL
SCOTT A. GURNEY
#PV-011719-015866
EXP. 9-17-2025

ION DEVELOPER LLC
DAVID STANLEY CONRAD
C - ELECTRICAL CONTRACTOR
CI524

ION SOLAR
44 E 800 N
OREM, UTAH 84057
888.781.7074

PROJECT ID
00ECXD

SITE OWNER
CHRIS J STAMBAUGH

SITE ADDRESS
7234 SOUTHEAST MAIN STREET
PORTLAND, OREGON 97215

EQUIP.
(21) SILFAB SOLAR SIL-430 QD
(21) ENPHASE IQ8MC-72-M-US

SYSTEM SIZE
9.03KW DC
6.72KW STC-AC, 8.266KW CEC-AC

PROJECT DESIGNER
A
VISHAL SHARMA

DATE
26-Jan-2025

SHEET NAME
ELECTRICAL LABELS

SHEET # E-10

REV A