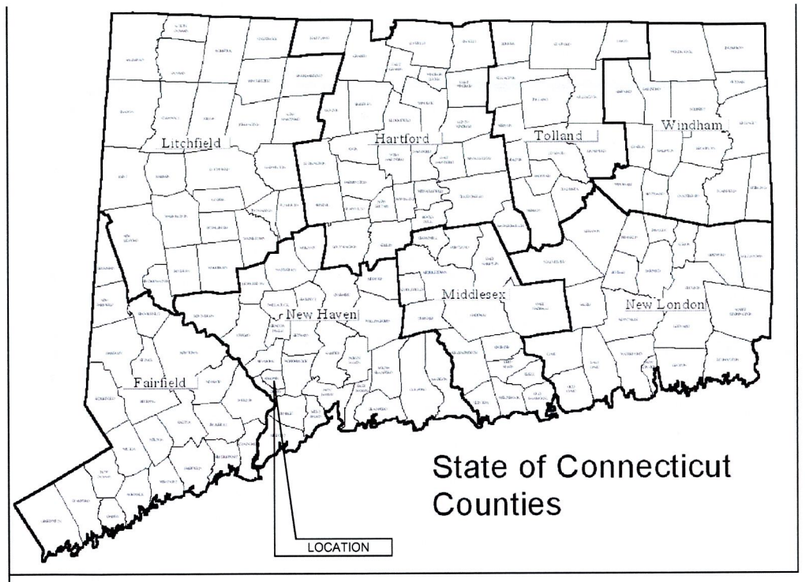
GROUND MOUNTED PV ARRAY INSTALLATION AT:

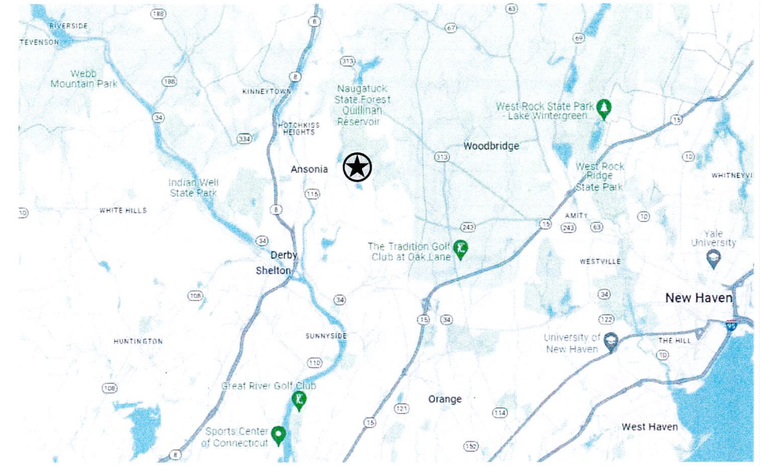
BENZ SOLAR
31 BENZ STREET

ANSONIA, CT 06041



LOCATION MAP

SCALE: N.T.S.



VICINITY MAP

SCALE: N.T.S.

APPLICABLE CODES

NATIONAL ELECTRIC CODE - 2020
ARTICLE 230 - SERVICES
ARTICLE 240 - OVERCURRENT PROTECTION
ARTICLE 250 - GROUNDING AND BONDING
ARTICLE 300 - WIRING METHODS
ARTICLE 310 - CONDUCTORS
ARTICLE 690 - SOLAR PHOTOVOLTAIC SYSTEMS
ARTICLE 705 - INTERCONNECTED ELECTRIC POWER PRODUCTION SOURCES

PV SYSTEM #1 INFORMATION

SYSTEM SIZE (DC):	1,348.620 kW STC + BIFACIAL GAIN
SYSTEM SIZE (AC):	999.000 kW
INVERTER QUANTITY:	8
INVERTER TYPE:	(7) KACO 125TL3 (125 KW) (1) KACO 125TL3 (124 KW / CURTAILED)
MODULE QUANTITY:	1,976
MODULE TYPE:	(988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL (680W STC) & (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL (685W STC)
RACKING MANUFACTURER:	APA

PV SYSTEM #2 INFORMATION

SYSTEM SIZE (DC):	1,348.620 kW STC + BIFACIAL GAIN
SYSTEM SIZE (AC):	999.000 kW
INVERTER QUANTITY:	8
INVERTER TYPE:	(7) KACO 125TL3 (125 KW) (1) KACO 125TL3 (124 KW / CURTAILED)
MODULE QUANTITY:	1,976
MODULE TYPE:	(988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL (680W STC) & (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL (685W STC)
RACKING MANUFACTURER:	APA

UTILITY INFORMATION

COMPANY:	UNITED ILLUMINATING
ACCOUNT NUMBER:	T.B.D. (NEW ACCOUNT)
METER NUMBERS:	T.B.D. (NEW METERS)
ZREC NUMBER	#ZL22227 (SYSTEM #1) & #ZL22229 (SYSTEM #2)

PROJECT DESCRIPTION

THIS INSTALLATION CONSISTS OF TWO UTILITY INTERACTIVE SOLAR PHOTOVOLTAIC SYSTEMS ON GROUND MOUNTED STRUCTURES, LOCATED IN ANSONIA, CONNECTICUT. THE SYSTEMS ARE COMPRISED OF MODULES MOUNTED TO GROUND MOUNTED RACKING STRUCTURES. THE INVERTERS ARE POWERED BY PARALLEL STRINGS OF MODULES IN SERIES FED THROUGH DC STRING COMBINER BOXES AND DC DISCONNECT SWITCHES. THE AC INVERTER OUTPUTS ARE COMBINED IN TWO PAD MOUNTED AC COMBINER SWITCHBOARDS. FROM EACH AC COMBINER SWITCHBOARD, POWER IS FED THROUGH A TRANSFORMER, CUSTOMER OWNED RECLOSER & PRIMARY METERING CABINET. FROM EACH METERING CABINET, POWER IS FED UNDERGROUND TO THE UTILITY COMPANY POLE SYSTEM.

DRAWING LIST

OTHER DRAWINGS

RACKING MANUFACTURER DRAWINGS
CIVIL ENGINEERING DRAWINGS

REVISIONS:

03-03-2023:	INTERCONNECTION APPLICATION SET
03-15-2024:	INTERCONNECTION APPLICATION REV #1
04-30-2024:	PROGRESS SET - FOR REVIEW
08-30-2024:	ISSUED FOR CONSTRUCTION
09-26-2024:	REVISIONS

PREPARED FOR:

ecos ENERGY

ecosrenewable.com

PREPARED BY:

SG ENGINEERING LLC

sgedesign.com

Stephen Gendreau, P.E.

Digitally signed by Stephen Gendreau, P.E.
Date: 2024.09.26 12:05:11 -04'00'

STATE OF CONNECTICUT · STEPHEN GENDREAU · LICENSED PROFESSIONAL ENGINEER

CUSTOMER OWNED RECLOSER RELAY SETTINGS

VNOM: 13800V, IMAX: 41.8A 60Hz
PT=66.4:1; CT=500:1

ANSI #	PICKUP			TOTAL (CLEARING TIME) / TIME DIAL		SETTING (CLEARING TIME) / TIME DIAL	
	V-P.U. / PERCENTAGE	V.PRIMARY	V.SECONDARY	CYCLES	SECONDS	CYCLES	SECONDS
27	0.50/50	3983.7	60.0	66	1.10	63	1.05
27	0.88/88	7011.3	105.6	120	2.00	117	1.95
59	1.10/110	8764.2	132.0	120	2.00	117	1.95
59	1.20/120	9560.9	144.0	9.6	0.16	6.6	0.11
		FREQUENCY					
81/U		58.5HZ		18000	300.00	17820	297
81/U		56.5HZ		9.6	0.16	6.6	0.11
81/O		61.2HZ		18000	300.00	17820	297
81/O		62.0HZ		9.6	0.16	6.6	0.11

	FUNCTION	PRIMARY	RELAY SETTING
51	AC INVERSE TIME OVERCURRENT	t.b.d.	t.b.d.

	FUNCTION	RELAY SETTING
79	RECLOSE FUNCTION	MINIMUM 5 MINUTE DELAY
51G	RESIDUAL TIME OVERCURRENT	t.b.d.
50/51P	PHASE INSTANTANEOUS / TIME OVER CURRENT	t.b.d.
59N	NEUTRAL OVERVOLTAGE RELAY	t.b.d.
50N	NEUTRAL INSTANTANEOUS OVERCURRENT	t.b.d.

RELAY NOTES:

1. TOTAL CLEARING TIME INCLUDES 3 CYCLES ESTIMATED OPENING TIME (0.05 SEC).
2. THE RELAY WILL BE PROGRAMMED TO TRIP THE MAIN DISCONNECT WITHIN 2-SEC WHEN THE BATTERY TEST FAILS OR WHEN THERE IS A RELAY HARDWARE FAILURE.
3. AUTO-RESTORATION SCHEME: RELAY PROGRAMMING LOGIC INCLUDED SUCH THAT THE SYSTEM WILL RESTORE THE INTERCONNECTION UPON THE STABILIZATION OF THE UTILITY VOLTAGE AND FREQUENCY AS WELL AS WITHOUT ANY LOCKOUT CONDITIONS. VOLTAGE AND FREQUENCY WILL BE SUPERVISED BY 27, 81 AND 59 ELEMENTS FOR A FIVE-MINUTE DURATION BEFORE CLOSE COMMAND IS INITIATED. DURING THIS DURATION, MANUAL CLOSE WILL BE BLOCKED.
4. LOCKOUT SCHEME: AUTO-RESTORATION IS LOCKED OUT IF THE CIRCUIT BREAKER IS MANUALLY OPENED OR IF THE BATTERY ALARM IS ASSERTED.

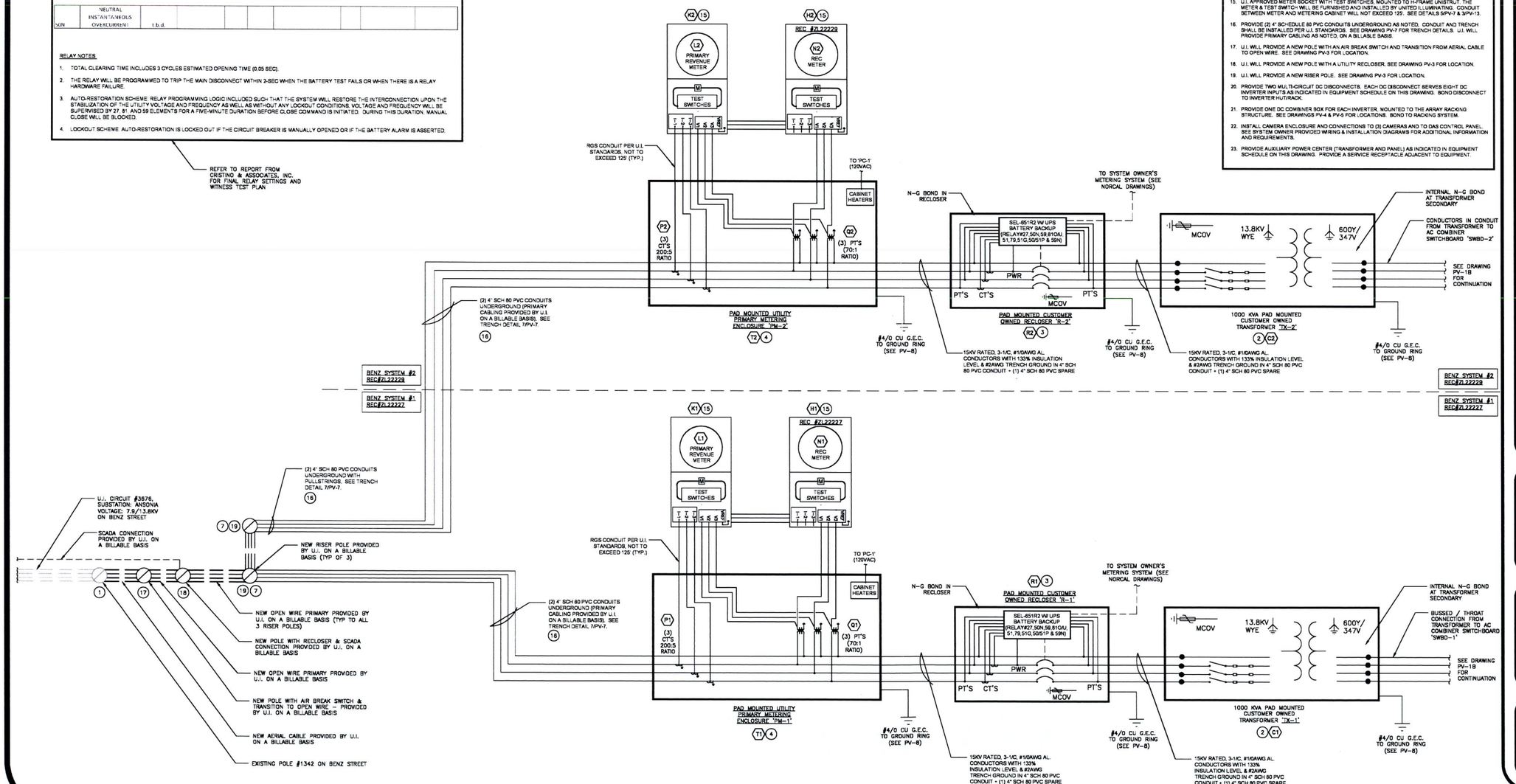
REFER TO REPORT FROM CRISTINO & ASSOCIATES, INC. FOR FINAL RELAY SETTINGS AND WITNESS TEST PLAN

EQUIPMENT SCHEDULE

DESIGNATION	ITEM	MAKE & MODEL #	NOTES	FURNISHED BY UTILITY COMPANY
C1	CUSTOMER OWNED TRANSFORMER TX-1	ABB	1000 KVA, DEAD FRONT, PAD MOUNTED, MINERAL OIL FILLED, 13.8KV GROUNDED WYE HV, 600V GROUNDED WYE LV, 60HZ, 95KV BIL, 8.5MVAZ, 65°C RISE, SUITABLE FOR REVERSE FEED, FUSING PER MANUFACTURER	NO
C2	CUSTOMER OWNED TRANSFORMER TX-2	JCL ENERGY	1000 KVA, DEAD FRONT, PAD MOUNTED, MINERAL OIL FILLED, 13.8KV GROUNDED WYE HV, 600V GROUNDED WYE LV, 60HZ, 95KV BIL, %Z TBD, 65°C RISE, SUITABLE FOR REVERSE FEED, FUSING PER MANUFACTURER	NO
H1 & H2	REC METER SOCKETS	MILBANK #S3390-F8-XL-C7	BASE METER ENCLOSURE, 2 POSITION, 28"W X 11"D X 34-11/16"H, 'A' BASE	NO
K1 & K2	NET REVENUE METER SOCKETS	MILBANK #S3390-F8-XL-C7	BASE METER ENCLOSURE, 2 POSITION, 28"W X 11"D X 34-11/16"H, 'A' BASE	NO
L1 & L2	NET REVENUE METERS	T.B.D.	FURNISHED & INSTALLED BY U.I.	YES
N1 & N2	REC METERS	T.B.D.	FURNISHED & INSTALLED BY U.I.	YES
P1 & P2	PRIMARY METER CURRENT TRANSFORMERS	ABB KON-11ER CATHE-923A427G10	200:5 RATIO, 3.0 RATING FACTOR @ 30°C, 0.15 B-0.1 TO B-0.5 ACCURACY	NO
Q1 & Q2	PRIMARY METER POTENTIAL TRANSFORMERS	ABB VZ-11 CAT #7523A89207	70:1 RATIO, 0.3Z ACCURACY, SUPPLIED WITH 0.5E PRIMARY FUSE	NO
R1 & R2	CUSTOMER OWNED VACUUM INTERRUPTERS / RECLOSERS	G&W VIPER-ST VIP38ER-12-1-ST	PAD MOUNTED, 15.5KV RATED, VACUUM INTERRUPTER, 110KV BIL, 12.5KA INTERRUPT RATING, 800A CONTINUOUS RATING, 200A BUSHING WELLS, SINGLE OR THREE-PHASE MANUAL OPERATION INTEGRAL, SEL-651R2 RELAY WITH 8-HOUR BATTERY BACKUP, WEATHERPROOF ENCLOSURE, RELAY SETTINGS TO BE COORDINATED WITH U.I.	NO
T1 & T2	PRIMARY METERING ENCLOSURES	SWITCHGEAR POWER SYSTEMS S.O.#4078, SERIAL #206754, P.O. #BENZ-006	PAD MOUNTED, 15KV CLASS, 200A RATED CONTINUOUS CURRENT, 95KV BIL, NEMA 3R, DEADFRONT, 120V STRIP HEATERS	NO

KEY NOTES

1. CONNECT SYSTEM TO EXISTING POLE #1342 ON THE EAST SIDE OF BENZ STREET, FED FROM U.I. CIRCUIT #3676, SUBSTATION "ANSONIA".
2. NEW PAD MOUNTED CUSTOMER OWNED TRANSFORMER (13.8KV GROUNDED WYE PRIMARY, 600V/347V GROUNDED WYE SECONDARY). PROVIDE TRANSFORMER VAULT/PAD & GROUNDING PER DETAILS ON DRAWING PV-8. FUSE SIZING PER MANUFACTURER'S REQUIREMENTS.
3. CUSTOMER OWNED PAD MOUNTED RECLOSER WITH SEL RELAY, VACUUM INTERRUPTER, MANUALLY OPERABLE. SEL RELAY WILL BE PROVIDED WITH 8-HOUR BATTERY BACKUP AND WILL PROVIDE OVERUNDER VOLTAGE AND OVERUNDER FREQUENCY PROTECTION PER TABLE ON PV-1A. REFER TO CRISTINO & ASSOC REPORT FOR FINAL RELAY SETTINGS AND WITNESS TEST PLAN. CONNECT G&W PROVIDED 3-PIN PT CABLE & WIRING PER G&W INSTRUCTIONS. POWER SEL RELAY FROM UTILITY SIDE OF THE RECLOSER.
4. PAD MOUNTED PRIMARY METERING ENCLOSURE. CUSTOMER WILL FURNISH CABINET, PAD, CTS, PT'S AND HOUSEWIRING. UNDERPUT FOR MOUNTING OF METERS. U.I. WILL INSTALL, OWN AND MAINTAIN THE CT'S AND PT'S. SEE DETAILS 7/PV-8 AND DRAWING PV-12 FOR REQUIREMENTS.
5. INSTALL GROUNDING WIRE ON AC SIDE OF INVERTER AND CONNECT BACK TO GROUNDING ELECTRODE OF THE EXISTING MAIN ELECTRICAL SERVICE. REFER TO DETAIL 2 ON PV-8.
6. NOTE NOT USED.
7. PROVIDE RIGID GALVANIZED CONDUIT SWEEPS AT BASE OF RISER POLE. SEE DETAIL 2/PV-7 FOR ADDITIONAL REQUIREMENTS.
8. MOUNT METEOROLOGICAL STATION (MET ENCLOSURE) IN LOCATION INDICATED ON PV-2. PROVIDE AND CONNECT ALL SENSORS, INCLUDING WEATHER, PYRANOMETER AND BACK OF MODULE SENSORS. SEE NORICAL WIRING DIAGRAMS FOR REQUIREMENTS.
9. INSTALL CELLULAR ANTENNA AND COAX CABLE TO DAS CONTROL PANEL. SEE NORICAL WIRING DIAGRAMS FOR REQUIREMENTS.
10. PROVIDE RS485 COMMUNICATION WIRING TO SYSTEM OWNER'S METER PER MANUFACTURER'S INSTRUCTIONS. DAISY CHAIN BETWEEN INVERTERS. SEE NORICAL WIRING DIAGRAMS.
11. PARALLEL STRINGS OF MODULES IN SERIES - REFER TO PV-3 FOR STRING WIRE CONFIGURATION & ROUTING.
12. INSTALL INVERTER AS INDICATED IN THE EQUIPMENT SCHEDULE ON THIS DRAWING. REFER TO THE "INVERTER DATA" TABLE ON THIS DRAWING FOR ADDITIONAL INFORMATION. PROVIDE NARROW TONGUE LUGS FOR INVERTER AC TERMINATIONS.
13. INSTALL AE EQUIPMENT GROUNDING CONDUCTOR AND BOND TO ALL PV ARRAY FRAMES, RACKING, AND MODULE FRAMES. CONNECT CONDUCTOR BACK TO DC GROUNDING BAR INSIDE INVERTER. REFER TO DETAIL 3 ON PV-8.
14. INSTALL AC COMBINER SWITCHBOARD AS INDICATED IN EQUIPMENT SCHEDULE ON THIS DRAWING. SEE QT CORPORATION DRAWINGS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
15. U.I. APPROVED METER SOCKET WITH TEST SWITCHES, MOUNTED TO H-FRAME UNISTRUT. THE METER & TEST SWITCH WILL BE FURNISHED AND INSTALLED BY UNITED ILLUMINATING. CONDUIT BETWEEN METER AND METERING CABINET WILL NOT EXCEED 125'. SEE DETAILS 5/PV-7 & 3/PV-13.
16. PROVIDE (2) 4" SCHEDULE 80 PVC CONDUITS UNDERGROUND AS NOTED. CONDUIT AND TRENCH SHALL BE INSTALLED PER U.I. STANDARDS. SEE DRAWING PV-7 FOR TRENCH DETAILS. U.I. WILL PROVIDE PRIMARY CABLING AS NOTED, ON A BILLABLE BASIS.
17. U.I. WILL PROVIDE A NEW POLE WITH AN AIR BREAK SWITCH AND TRANSITION FROM AERIAL CABLE TO OPEN WIRE. SEE DRAWING PV-3 FOR LOCATION.
18. U.I. WILL PROVIDE A NEW POLE WITH A UTILITY RECLOSER. SEE DRAWING PV-3 FOR LOCATION.
19. U.I. WILL PROVIDE A NEW RISER POLE. SEE DRAWING PV-3 FOR LOCATION.
20. PROVIDE TWO MULTI-CIRCUIT DC DISCONNECTS. EACH DC DISCONNECT SERVES EIGHT DC INVERTER INPUTS AS INDICATED IN EQUIPMENT SCHEDULE ON THIS DRAWING. BOND DISCONNECT TO INVERTER HUT/RACK.
21. PROVIDE ONE DC COMBINER BOX FOR EACH INVERTER, MOUNTED TO THE ARRAY RACKING STRUCTURE. SEE DRAWINGS PV-4 & PV-5 FOR LOCATIONS. BOND TO RACKING SYSTEM.
22. INSTALL CAMERA ENCLOSURE AND CONNECTIONS TO (3) CAMERAS AND TO DAS CONTROL PANEL. SEE SYSTEM OWNER PROVIDED WIRING & INSTALLATION DIAGRAMS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
23. PROVIDE AUXILIARY POWER CENTER (TRANSFORMER AND PANEL) AS INDICATED IN EQUIPMENT SCHEDULE ON THIS DRAWING. PROVIDE A SERVICE RECEPTACLE ADJACENT TO EQUIPMENT.



Project Info

PREPARED BY:

SG ENGINEERING LLC

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PREPARED FOR:

ecos ENERGY

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MINNEAPOLIS, MN 55402
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TYPICAL SYSTEM INFO (FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT · SCHER GENOVESE · LICENSED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

THREE-LINE DIAGRAM
(PART 1 OF 3)

Project	Sheet
Date: SEPTEMBER 26, 2024	PV-1A
Scale: NTS	

EQUIPMENT SCHEDULE

DESIGNATION	ITEM	MAKE & MODEL #	NOTES	FURNISHED BY UTILITY COMPANY?
A1 & A2	AC COMBINER SWITCHBOARDS	QT / SIEMENS OR EQUAL	600VAC, 3PH, 4W, 1200A RATED, 65KAIC, NEMA 3R, BREAKER SIZES & QUANTITIES AS INDICATED, GFP MAIN BREAKER, ARC ENERGY REDUCTION SWITCH	NO
Z	AUXILIARY POWER CENTER WITH TRANSFORMER	SIEMENS OR EQUAL	POWER CENTER WITH 7500KVA TRANSFORMER (600VAC, 1-PH TO 240/120V, 1-PH), 40A-2P MCB, BRANCH BREAKERS AS INDICATED	NO

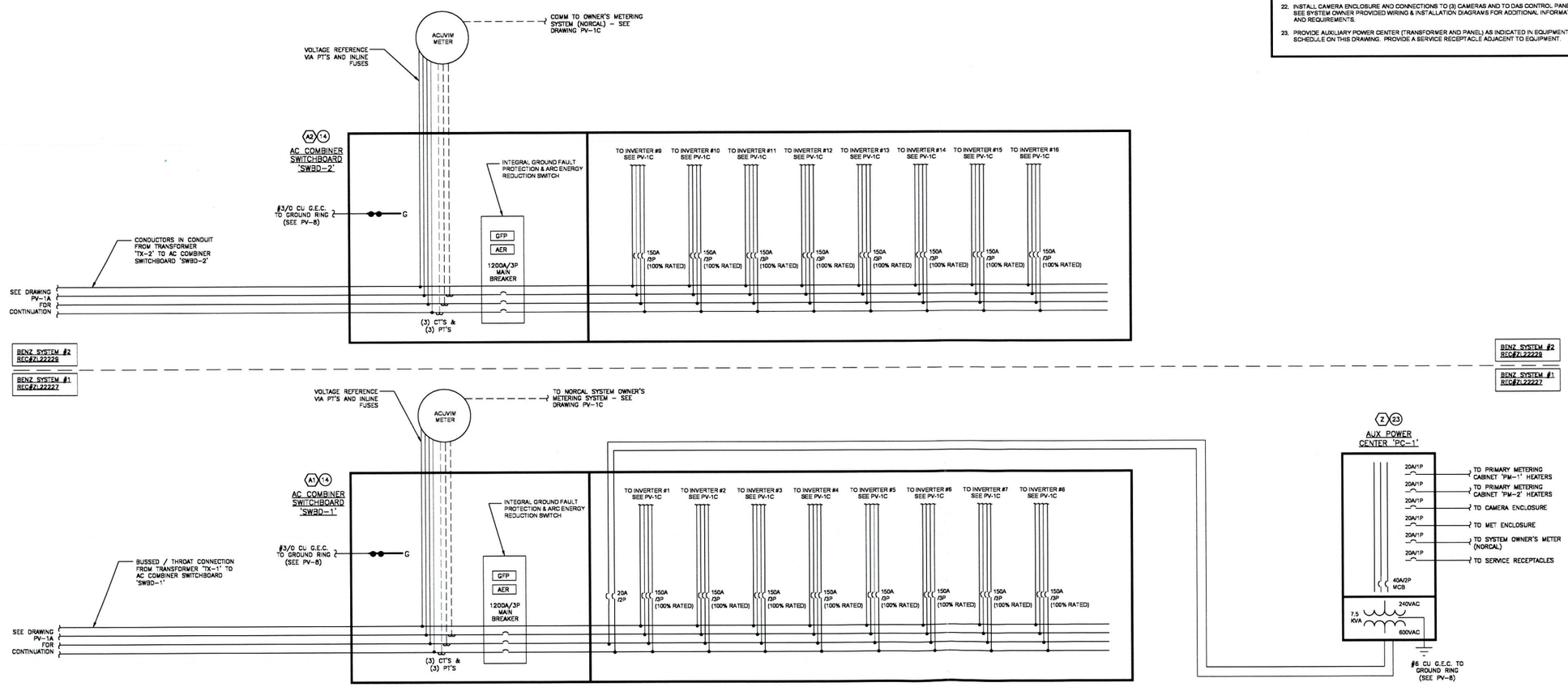
AC FEEDER SCHEDULE

LOCATION	LENGTH	# OF PARALLEL CONDUITS	CONDUIT SIZE	CONDUIT TYPE	CONDUCTORS	NEUTRAL	GND	CONDUCTOR MATERIAL	CONDUCTOR TYPE	MIN CONDUCTOR RATING	FILL FACTOR	VOLTAGE DROP
SWBD-1 TO INVERTER 1	40'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.2%
SWBD-1 TO INVERTER 2	35'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.2%
SWBD-1 TO INVERTER 3	25'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.1%
SWBD-1 TO INVERTER 4	20'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.1%
SWBD-1 TO INVERTER 5	20'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.2%
SWBD-1 TO INVERTER 6	25'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.2%
SWBD-1 TO INVERTER 7	35'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.2%
SWBD-1 TO INVERTER 8	40'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.2%
SWBD-2 TO INVERTER 9	55'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.3%
SWBD-2 TO INVERTER 10	60'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.3%
SWBD-2 TO INVERTER 11	65'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.3%
SWBD-2 TO INVERTER 12	70'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.4%
SWBD-2 TO INVERTER 13	55'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.3%
SWBD-2 TO INVERTER 14	60'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.3%
SWBD-2 TO INVERTER 15	65'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.3%
SWBD-2 TO INVERTER 16	70'	1	2"	PVC	3 #3/0	N/A	1 #4	ALUMINUM	XHHW-2	600VAC	25.7%	0.4%
SWBD-1 TO PC-1	15'	1	0.75"	PVC	2#12	N/A	1 #12	COPPER	XHHW-2	600VAC	12.2%	0.1%
PC-1 TO SYSTEM OWNER'S METER	10'	1	0.75"	PVC	1#12	1 #12	1 #12	COPPER	XHHW-2	600VAC	12.2%	0.2%
PC-1 TO SERVICE RECEPTACLES	10'	1	0.75"	PVC	1#12	1 #12	1 #12	COPPER	XHHW-2	600VAC	12.2%	0.2%
PC-1 TO PRIMARY METER CABINET PM-1 HEATERS	40'	1	0.75"	PVC	1#12	1 #12	1 #12	COPPER	XHHW-2	600VAC	12.2%	0.3%
PC-1 TO MET ENCLOSURE	10'	1	0.75"	PVC	1#12	1 #12	1 #12	COPPER	XHHW-2	600VAC	12.2%	0.2%
PC-1 TO CAMERA ENCLOSURE	10'	1	0.75"	PVC	1#12	1 #12	1 #12	COPPER	XHHW-2	600VAC	12.2%	0.2%
PC-1 TO PRIMARY METER CABINET PM-2 HEATERS	55'	1	0.75"	PVC	1#12	1 #12	1 #12	COPPER	XHHW-2	600VAC	12.2%	0.4%
TX-2 TO SWBD-2	15'	3	4"	PVC	3 #600	1 #600	1 #3/0	COPPER	XHHW-2	600VAC	28.7%	0.1%
PM-1 TO R-1	20'	1	4"	PVC	3 #1/0	1 #1/0	1 #2	ALUMINUM	MV-105	15KV	30.1%	0.0%
R-1 TO TX-1	15'	1	4"	PVC	3 #1/0	1 #1/0	1 #2	ALUMINUM	MV-105	15KV	30.1%	0.0%
PM-2 TO R-2	20'	1	4"	PVC	3 #1/0	1 #1/0	1 #2	ALUMINUM	MV-105	15KV	30.1%	0.0%
R-2 TO TX-2	30'	1	4"	PVC	3 #1/0	1 #1/0	1 #2	ALUMINUM	MV-105	15KV	30.1%	0.0%
PC-1 TO PRIMARY METER CABINET PM-3 HEATERS (FUTURE)	75'	1	0.75"	PVC	1#12	1 #12	1 #12	COPPER	XHHW-2	600VAC	12.2%	0.6%

NOTE - ONE WAY LENGTHS OF RUN INDICATED IN THIS TABLE ARE FOR VOLTAGE DROP CALCULATION PURPOSES ONLY. CONTRACTOR SHALL FIELD VERIFY EXACT LENGTHS.

KEY NOTES

1. CONNECT SYSTEM TO EXISTING POLE #1342 ON THE EAST SIDE OF BENZ STREET, FED FROM U.I. CIRCUIT #3678, SUBSTATION "ANSONIA".
2. NEW PAD MOUNTED CUSTOMER OWNED TRANSFORMER (13.8KV GROUNDED WYE PRIMARY, 600V/347V GROUNDED WYE SECONDARY). PROVIDE TRANSFORMER VAULT/PAD & GROUNDING PER DETAILS ON DRAWING PV-9. FUSE SIZING PER MANUFACTURER'S REQUIREMENTS.
3. CUSTOMER OWNED PAD MOUNTED RECLOSER WITH SEL RELAY, VACUUM INTERRUPTER, MANUALLY OPERABLE. SEL RELAY WILL BE PROVIDED WITH 8-HOUR BATTERY BACKUP AND WILL PROVIDE OVERRUNDER VOLTAGE AND OVERRUNDER FREQUENCY PROTECTION PER TABLE ON PV-1A. REFER TO CRISTINO & ASSOC REPORT FOR FINAL RELAY SETTINGS AND WITNESS TEST PLAN. CONNECT G&W PROVIDED 32-PIN PT CABLE & WIRING PER G&W INSTRUCTIONS. POWER SEL RELAY FROM UTILITY SIDE OF THE RECLOSER.
4. PAD MOUNTED PRIMARY METERING ENCLOSURE. CUSTOMER WILL FURNISH CABINET, PAD, CT'S, PT'S AND H-CHANNEL UNISTRUT FOR MOUNTING OF METERS. U.I. WILL INSTALL, OWN AND MAINTAIN THE CT'S AND PT'S. SEE DETAILS 7/PV-8 AND DRAWING PV-12 FOR REQUIREMENTS.
5. INSTALL GROUNDING WIRE ON AC SIDE OF INVERTER AND CONNECT BACK TO GROUNDING ELECTRODE OF THE EXISTING MAIN ELECTRICAL SERVICE. REFER TO DETAIL 2 ON PV-8.
6. NOTE NOT USED.
7. PROVIDE RIGID GALVANIZED CONDUIT SWEEPS AT BASE OF RISER POLE. SEE DETAIL 2/PV-7 FOR ADDITIONAL REQUIREMENTS.
8. MOUNT METEOROLOGICAL STATION (MET ENCLOSURE) IN LOCATION INDICATED ON PV-2. PROVIDE AND CONNECT ALL SENSORS, INCLUDING WEATHER, PYRANOMETER AND BACK OF MODULE SENSORS. SEE NORCAL WIRING DIAGRAMS FOR REQUIREMENTS.
9. INSTALL CELLULAR ANTENNA AND COAX CABLE TO DAS CONTROL PANEL. SEE NORCAL WIRING DIAGRAMS FOR REQUIREMENTS.
10. PROVIDE RS485 COMMUNICATION WIRING TO SYSTEM OWNER'S METER PER MANUFACTURER'S INSTRUCTIONS. DAISY CHAIN BETWEEN INVERTERS. SEE NORCAL WIRING DIAGRAMS.
11. PARALLEL STRINGS OF MODULES IN SERIES - REFER TO PV-3 FOR STRING WIRE CONFIGURATION & ROUTING.
12. INSTALL INVERTER AS INDICATED IN THE EQUIPMENT SCHEDULE ON THIS DRAWING. REFER TO THE "INVERTER DATA" TABLE ON THIS DRAWING FOR ADDITIONAL INFORMATION. PROVIDE NARROW TONGUE LUGS FOR INVERTER AC TERMINATIONS.
13. INSTALL #6 EQUIPMENT GROUNDING CONDUCTOR AND BOND TO ALL PV ARRAY FRAMES, RACKING, AND MODULE FRAMES. CONNECT CONDUCTOR BACK TO DC GROUNDING BAR INSIDE INVERTER. REFER TO DETAIL 2 ON PV-8.
14. INSTALL AC COMBINER SWITCHBOARD AS INDICATED IN EQUIPMENT SCHEDULE ON THIS DRAWING. SEE QT CORPORATION DRAWINGS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
15. U.I. APPROVED METER SOCKET WITH TEST SWITCHES, MOUNTED TO H-FRAME UNISTRUT. THE METER & TEST SWITCH WILL BE FURNISHED AND INSTALLED BY UNITED ILLUMINATING. CONDUIT BETWEEN METER AND METERING CABINET WILL NOT EXCEED 125'. SEE DETAILS 5/PV-7 & 3/PV-13.
16. PROVIDE (2) 4" SCHEDULE 80 PVC CONDUITS UNDERGROUND AS NOTED. CONDUIT AND TRENCH SHALL BE INSTALLED PER U.I. STANDARDS. SEE DRAWING PV-7 FOR TRENCH DETAILS. U.I. WILL PROVIDE PRIMARY CABLING AS NOTED, ON A BILLABLE BASIS.
17. U.I. WILL PROVIDE A NEW POLE WITH AN AIR BREAK SWITCH AND TRANSITION FROM AERIAL CABLE TO OPEN WIRE. SEE DRAWING PV-3 FOR LOCATION.
18. U.I. WILL PROVIDE A NEW POLE WITH A UTILITY RECLOSER. SEE DRAWING PV-3 FOR LOCATION.
19. U.I. WILL PROVIDE A NEW RISER POLE. SEE DRAWING PV-3 FOR LOCATION.
20. PROVIDE TWO MULTI-CIRCUIT DC DISCONNECTS. EACH DC DISCONNECT SERVES EIGHT DC INVERTER INPUTS AS INDICATED IN EQUIPMENT SCHEDULE ON THIS DRAWING. BOND DISCONNECT TO INVERTER HUT/RACK.
21. PROVIDE ONE DC COMBINER BOX FOR EACH INVERTER, MOUNTED TO THE ARRAY RACKING STRUCTURE. SEE DRAWINGS PV-4 & PV-5 FOR LOCATIONS. BOND TO RACKING SYSTEM.
22. INSTALL CAMERA ENCLOSURE AND CONNECTIONS TO (3) CAMERAS AND TO DAS CONTROL PANEL. SEE SYSTEM OWNER PROVIDED WIRING & INSTALLATION DIAGRAMS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.
23. PROVIDE AUXILIARY POWER CENTER (TRANSFORMER AND PANEL) AS INDICATED IN EQUIPMENT SCHEDULE ON THIS DRAWING. PROVIDE A SERVICE RECEPTACLE ADJACENT TO EQUIPMENT.



Project Info

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TYPICAL SYSTEM INFO (FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT · BRIAN GENDREAU · 28240 · LICENSED · PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

THREE-LINE DIAGRAM
(PART 2 OF 3)

Project

Date
SEPTEMBER 26, 2024

Scale
NTS

Sheet
PV-1B

KEY NOTES

1. CONNECT SYSTEM TO EXISTING POLE #1342 ON THE EAST SIDE OF BENZ STREET, FED FROM U.I. CIRCUIT #3876, SUBSTATION "ANSONIA".
2. NEW PAD MOUNTED CUSTOMER OWNED TRANSFORMER (13.8KV GROUNDED WYE PRIMARY, 600V/347V GROUNDED WYE SECONDARY). PROVIDE TRANSFORMER VAULT/PAD & GROUNDING PER DETAILS ON DRAWING PV-8. FUSE SIZING PER MANUFACTURER'S REQUIREMENTS.
3. CUSTOMER OWNED PAD MOUNTED RECLOSER WITH SEL RELAY, VACUUM INTERRUPTER, MANUALLY OPERABLE. SEL RELAY WILL BE PROVIDED WITH 8-HOUR BATTERY BACKUP AND WILL PROVIDE OVERUNDER VOLTAGE AND OVERUNDER FREQUENCY PROTECTION PER TABLE ON PV-1A. REFER TO CRISTING & ASSOC REPORT FOR FINAL RELAY SETTINGS AND WITNESS TEST PLAN. CONNECT G&W PROVIDED 32-PIN PT CABLE & WIRING PER G&W INSTRUCTIONS. POWER SEL RELAY FROM UTILITY SIDE OF THE RECLOSER.
4. PAD MOUNTED PRIMARY METERING ENCLOSURE. CUSTOMER WILL FURNISH CABINET, PAD, CT'S, PT'S AND H-CHANNEL UNISTRUT FOR MOUNTING OF METERS. U.I. WILL INSTALL, OWN AND MAINTAIN THE CT'S AND PT'S. SEE DETAILS 7PV-8 AND DRAWING PV-12 FOR REQUIREMENTS.
5. INSTALL GROUNDING WIRE ON AC SIDE OF INVERTER AND CONNECT BACK TO GROUNDING ELECTRODE OF THE EXISTING MAIN ELECTRICAL SERVICE. REFER TO DETAIL 2 ON PV-8.
6. NOTE NOT USED.
7. PROVIDE RIGID GALVANIZED CONDUIT SWEEPS AT BASE OF RISER POLE. SEE DETAIL 2PV-7 FOR ADDITIONAL REQUIREMENTS.
8. MOUNT METEOROLOGICAL STATION (MET ENCLOSURE) IN LOCATION INDICATED ON PV-2. PROVIDE AND CONNECT ALL SENSORS, INCLUDING WEATHER, PYRANOMETER AND BACK OF MODULE SENSORS. SEE NORCAL WIRING DIAGRAMS FOR REQUIREMENTS.
9. INSTALL CELLULAR ANTENNA AND COAX CABLE TO DAS CONTROL PANEL. SEE NORCAL WIRING DIAGRAMS FOR REQUIREMENTS.
10. PROVIDE RS485 COMMUNICATION WIRING TO SYSTEM OWNER'S METER PER MANUFACTURER'S INSTRUCTIONS. DAISY CHAIN BETWEEN INVERTERS. SEE NORCAL WIRING DIAGRAMS.
11. PARALLEL STRINGS OF MODULES IN SERIES - REFER TO PV-3 FOR STRING WIRE CONFIGURATION & ROUTING.
12. INSTALL INVERTER AS INDICATED IN THE EQUIPMENT SCHEDULE ON THIS DRAWING. REFER TO THE INVERTER DATA TABLE ON THIS DRAWING FOR ADDITIONAL INFORMATION. PROVIDE NARROW TONGUE LUGS FOR INVERTER AC TERMINATIONS.
13. INSTALL #6 EQUIPMENT GROUNDING CONDUCTOR AND BOND TO ALL PV ARRAY FRAMES, RACKING, AND MODULE FRAMES. CONNECT CONDUCTOR BACK TO DC GROUNDING BAR INSIDE INVERTER. REFER TO DETAIL 2 ON PV-8.
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23. PROVIDE AUXILIARY POWER CENTER (TRANSFORMER AND PANEL) AS INDICATED IN EQUIPMENT SCHEDULE ON THIS DRAWING. PROVIDE A SERVICE RECEPTACLE ADJACENT TO EQUIPMENT.

INVERTER RELAY SETTINGS (UL1741 SA)

Shall Trip Function	Required Settings	
	Voltage (p.u. of nominal voltage)	Clearing Time(s)
OV2	1.20	0.16
OV1	1.10	2.0
UV1	0.88	2.0
UV2	0.50	1.1

TABLE I: INVERTERS' VOLTAGE TRIP SETTINGS

Shall Trip Function	Required Settings	
	Frequency (Hz)	Clearing Time(s)
OF2	62.0	0.16
OF1	61.2	300.0
UF1	58.5	300.0
UF2	58.5	0.16

TABLE II: INVERTERS' FREQUENCY TRIP SETTINGS

Voltage Range (p.u.)	Operating Mode/ Response	Minimum Ride-through Time(s) (design criteria)	Maximum Response Time(s) (design criteria)
$V > 1.20$	Cease to Energize	N/A	0.16
$1.10 < V \le 1.20$	Permissive Operation	0.2	N/A
$1.20 < V \le 1.10$	Mandatory Operation	1	N/A
$0.50 < V \le 0.88$	Permissive Operation	10	N/A
$0.00 \le V \le 0.50$	Continuous Operation	infinite	N/A
$0.88 \le V \le 1.10$	Mandatory Operation	Linear slope of 1 (1 pu x voltage change in 1 pu) of 0.5 sec. $T_{MP} = 3 \times \frac{0.7 + 1}{(2.5 \times V - 0.85 \times 1)}$	N/A
$0.45 \le V < 0.50$	Permissive Operation[a]	0.32	N/A
$0.00 \le V < 0.45$	Permissive Operation[b]	0.16	N/A
$V > 0.00$	Cease to energize	N/A	0.16

The following additional operational requirements shall apply for all inverters
a. In the Permissive Operation region above 0.5 p.u., inverters shall ride-through in Mandatory Operation mode, and
b. In the Permissive Operation region below 0.5 p.u., inverters shall ride-through in Momentary Cessation mode with a maximum response time of 0.083 seconds.

TABLE III: INVERTERS' VOLTAGE RIDE-THROUGH CAPABILITY & OPERATIONAL REQUIREMENTS

Frequency Range (Hz)	Operating Mode	Minimum Time(s) (design criteria)
$f > 62.0$	No ride through requirements apply to this range	
$61.2 < f \le 61.8$	Mandatory Operation	299
$58.8 \le f < 61.2$	Continuous Operation	Infinite
$57.0 < f < 58.8$	Mandatory Operation	299
$f < 57.0$	No ride-through requirements apply to this range	

TABLE IV: INVERTERS' FREQUENCY RIDE-THROUGH CAPABILITY

Function	Default Activation State
SPF, Specified Power Factor	OFF
QVP, Volt-Var Function with Watt or Var Priority	OFF
SS, Soft-Start Ramp Rate	ON Default value: 2% of maximum current output per second
FW, Freq-Watt Function OFF	OFF

TABLE V: GRID SUPPORT UTILITY INTERACTIVE INVERTER FUNCTIONS STATUS

NOTE - INVERTERS TO BE SET TO ISO NE COUNTRY CODE TO COMPLY WITH GRID PROTECTION SETTINGS

EQUIPMENT SCHEDULE

DESIGNATION	ITEM	MAKE & MODEL #	NOTES	FURNISHED BY UTILITY COMPANY?
B	DC COMBINER BOX (TYP)	TERRASMART OR EQUAL	2-POLE OUTPUT, 320A CONTINUOUS RATED, 1500VDC DISCONNECT, 100% LOAD BREAK RATED, INTEGRAL SURGE SUPPRESSION, NEMA 4X ENCLOSURE, 10 STRING CAPACITY	NO
D	OWNER'S PRODUCTION METER	NOR-CAL CONTROLS	DAS	NO
E1	PYRANOMETER (TYP)	HUKSEFLUX SR30	PROVIDE WIRING TO MET ENCLOSURE	NO
E2	BACK OF MODULE SENSOR (TYP)	MANUFACTURER T.B.D.	PROVIDE WIRING TO MET ENCLOSURE	NO
E3	WEATHER SENSOR (TYP)	LUFFT WS600	PROVIDE WIRING TO MET ENCLOSURE	NO
F1	INVERTER TYPE F1 (TYP)	KACO 125TL3	SEE INVERTER INFO ON THIS SHEET	NO
F2	INVERTER TYPE F2 (TYP)	KACO 125TL3 CURTAILED TO 124KWAC	SEE INVERTER INFO ON THIS SHEET, CURTAILED TO 124KWAC	NO
G	PV MODULES (TYP)	CANADIAN SOLAR CS7N-680TB-AG (680 WATTS) & CS7N-685TB-AG (685 WATTS), BIFACIAL, 1500VDC MAX	SEE DATA SHEETS ON PV-9, SEE TABLE ON DRAWING PV-6 FOR WHICH MODULES ARE USED ON EACH STRING	NO
M1 & M2	DC DISCONNECT SWITCHES	TERRASMART OR EQUAL	16-POLE, 320A CONTINUOUS RATED, 1500VDC RATED, NON-LOAD BREAK TYPE, NEMA 4X ENCLOSURE	NO

INVERTER DATA

	INVERTER TYPE F1	INVERTER TYPE F2
MANUFACTURER	KACO	KACO
MODEL #	125TL3	125TL3
STRINGS PER INVERTER	SEE PV-6	SEE PV-6
MODULES / STRING	SEE PV-6	SEE PV-6
MODULE QUANTITY	SEE PV-6	SEE PV-6
MODULE WATTS (W)	SEE PV-6	SEE PV-6
PANEL SC CURRENT (A)	18.29 / 18.34	18.29 / 18.34
STRING FUSE SIZE	35A	35A
COMBINER BOX WATTS	######	######
INTEGRAL AFCI?	TBD	TBD
INTEGRAL GFCI?	TBD	TBD
MAX DC VOLTAGE (V)	1500	1500
MAX DC CURRENT (A)	160	160
AC OUTPUT POWER (KW)	125	124
AC OUTPUT VOLTAGE (V)	600	600
AC OUTPUT CURRENT (A)	120.3	119.3
WYE OR DELTA?	DELTA	DELTA
UL 1741 SA CERTIFIED?	YES	YES

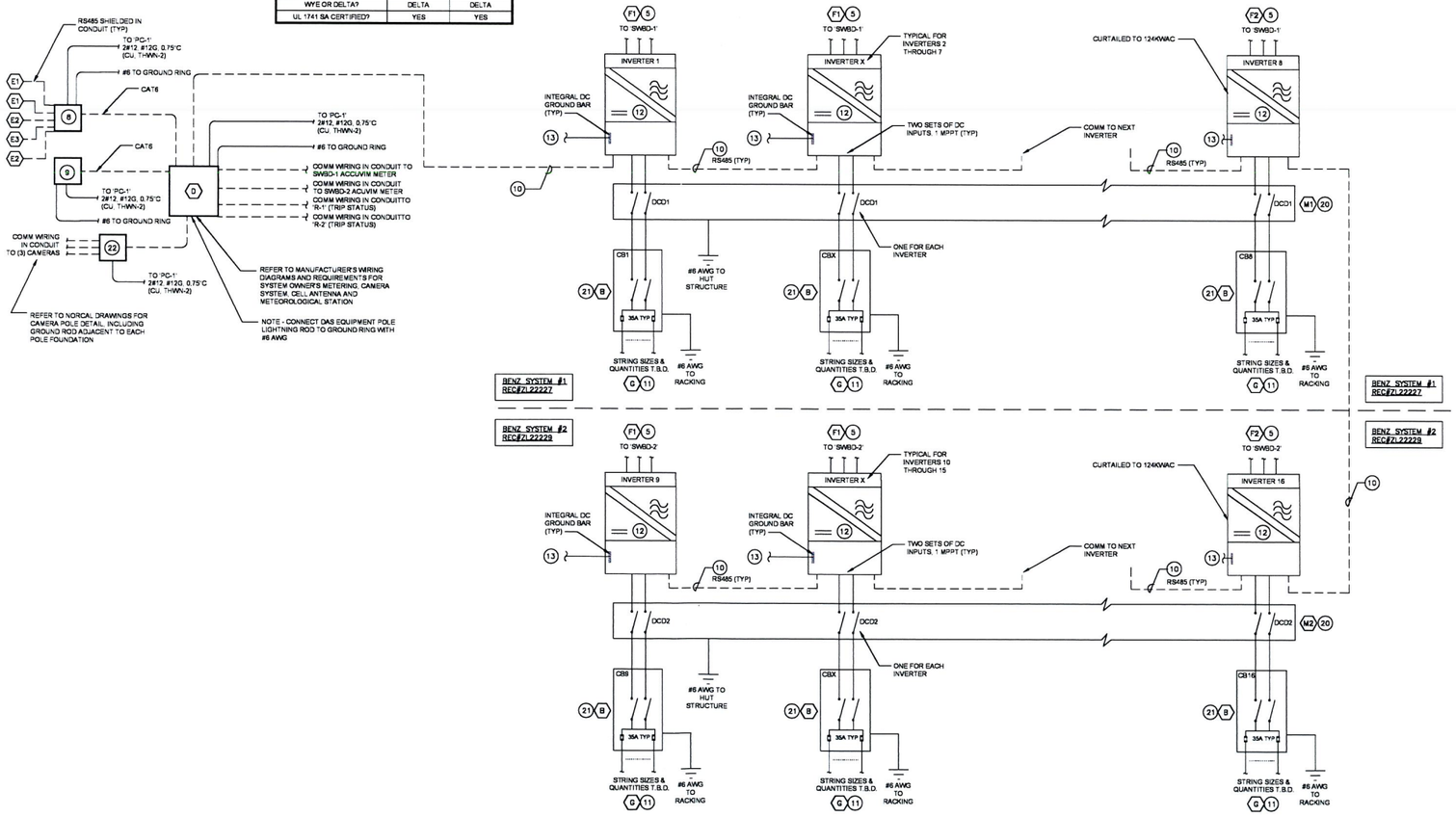
INVERTER TYPE 'F2' IS CURTAILED TO 124KWAC

STATED VALUES ARE STC NOT INCLUDING BIFACIAL GAIN

DC FEEDER SCHEDULE

LOCATION	LENGTH (FEET)	# OF PARALLEL CONDUITS	CONDUIT SIZE	CONDUIT TYPE	CONDUCTORS PER CONDUIT	GND PER CONDUIT	CONDUCTOR MATERIAL	CONDUCTOR TYPE	CONDUCTOR RATING	FILL FACTOR	VOLTAGE DROP
CB-1 TO DCD1	0	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
DCD1 TO INVERTER 1	20	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
CB-2 TO DCD1	0	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
DCD1 TO INVERTER 2	15	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.1%
CB-3 TO DCD1	0	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
DCD1 TO INVERTER 3	10	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
CB-4 TO DCD1	0	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
DCD1 TO INVERTER 4	5	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
CB-5 TO DCD1	0	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
DCD1 TO INVERTER 5	5	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
CB-6 TO DCD1	0	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
DCD1 TO INVERTER 6	10	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.1%
CB-7 TO DCD1	0	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
DCD1 TO INVERTER 7	15	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
CB-8 TO DCD1	0	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
DCD1 TO INVERTER 8	20	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.2%
CB-9 TO DCD2	0	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
DCD2 TO INVERTER 9	5	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
CB-10 TO DCD2	0	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
DCD2 TO INVERTER 10	10	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.1%
CB-11 TO DCD2	0	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
DCD2 TO INVERTER 11	15	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
CB-12 TO DCD2	0	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
DCD2 TO INVERTER 12	20	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
CB-13 TO DCD2	0	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
DCD2 TO INVERTER 13	5	1	3"	PVC	2#500	1 #1	ALUMINUM	PV WIRE	2000V	26.4%	0.0%
CB-14 TO DCD2	0	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
DCD2 TO INVERTER 14	10	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.1%
CB-15 TO DCD2	0	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
DCD2 TO INVERTER 15	15	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.1%
CB-16 TO DCD2	0	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.0%
DCD2 TO INVERTER 16	20	1	4"	PVC	2#750	1 #1	ALUMINUM	PV WIRE	2000V	21.6%	0.2%

NOTE - ONE WAY LENGTHS OF RUN INDICATED IN THIS TABLE ARE FOR VOLTAGE DROP CALCULATION PURPOSES ONLY. CONTRACTOR SHALL FIELD VERIFY EXACT LENGTHS.



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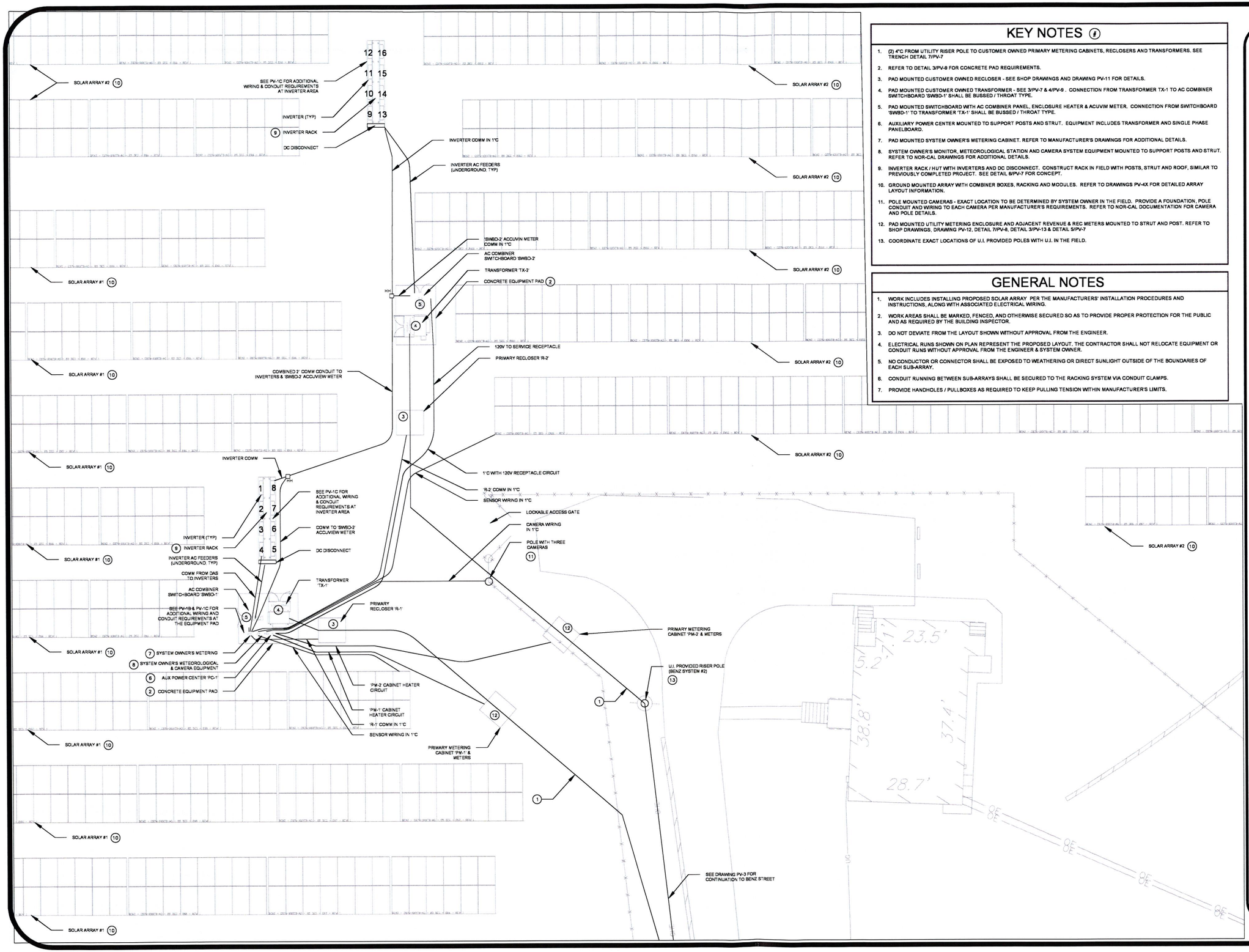

KEY NOTES

1. (2) 4"C FROM UTILITY RISER POLE TO CUSTOMER OWNED PRIMARY METERING CABINETS, RECLOSERS AND TRANSFORMERS. SEE TRENCH DETAIL 7/PV-7
2. REFER TO DETAIL 3/PV-8 FOR CONCRETE PAD REQUIREMENTS.
3. PAD MOUNTED CUSTOMER OWNED RECLOSER - SEE SHOP DRAWINGS AND DRAWING PV-11 FOR DETAILS.
4. PAD MOUNTED CUSTOMER OWNED TRANSFORMER - SEE 3/PV-7 & 4/PV-9 . CONNECTION FROM TRANSFORMER TX-1 TO AC COMBINER SWITCHBOARD 'SWBD-1' SHALL BE BUSSED / THROAT TYPE.
5. PAD MOUNTED SWITCHBOARD WITH AC COMBINER PANEL, ENCLOSURE HEATER & ACUVIM METER. CONNECTION FROM SWITCHBOARD 'SWBD-1' TO TRANSFORMER 'TX-1' SHALL BE BUSSED / THROAT TYPE.
6. AUXILIARY POWER CENTER MOUNTED TO SUPPORT POSTS AND STRUT. EQUIPMENT INCLUDES TRANSFORMER AND SINGLE PHASE PANELBOARD.
7. PAD MOUNTED SYSTEM OWNER'S METERING CABINET. REFER TO MANUFACTURER'S DRAWINGS FOR ADDITIONAL DETAILS.
8. SYSTEM OWNER'S MONITOR, METEOROLOGICAL STATION AND CAMERA SYSTEM EQUIPMENT MOUNTED TO SUPPORT POSTS AND STRUT. REFER TO NOR-CAL DRAWINGS FOR ADDITIONAL DETAILS.
9. INVERTER RACK / HUT WITH INVERTERS AND DC DISCONNECT. CONSTRUCT RACK IN FIELD WITH POSTS, STRUT AND ROOF, SIMILAR TO PREVIOUSLY COMPLETED PROJECT. SEE DETAIL 6/PV-7 FOR CONCEPT.
10. GROUND MOUNTED ARRAY WITH COMBINER BOXES, RACKING AND MODULES. REFER TO DRAWINGS PV-4X FOR DETAILED ARRAY LAYOUT INFORMATION.
11. POLE MOUNTED CAMERAS - EXACT LOCATION TO BE DETERMINED BY SYSTEM OWNER IN THE FIELD. PROVIDE A FOUNDATION, POLE CONDUIT AND WIRING TO EACH CAMERA PER MANUFACTURER'S REQUIREMENTS. REFER TO NOR-CAL DOCUMENTATION FOR CAMERA AND POLE DETAILS.
12. PAD MOUNTED UTILITY METERING ENCLOSURE AND ADJACENT REVENUE & REC METERS MOUNTED TO STRUT AND POST. REFER TO SHOP DRAWINGS, DRAWING PV-12, DETAIL 7/PV-8, DETAIL 3/PV-13 & DETAIL 5/PV-7
13. COORDINATE EXACT LOCATIONS OF U.I. PROVIDED POLES WITH U.I. IN THE FIELD.

GENERAL NOTES

1. WORK INCLUDES INSTALLING PROPOSED SOLAR ARRAY PER THE MANUFACTURERS' INSTALLATION PROCEDURES AND INSTRUCTIONS, ALONG WITH ASSOCIATED ELECTRICAL WIRING.
2. WORK AREAS SHALL BE MARKED, FENCED, AND OTHERWISE SECURED SO AS TO PROVIDE PROPER PROTECTION FOR THE PUBLIC AND AS REQUIRED BY THE BUILDING INSPECTOR.
3. DO NOT DEVIATE FROM THE LAYOUT SHOWN WITHOUT APPROVAL FROM THE ENGINEER.
4. ELECTRICAL RUNS SHOWN ON PLAN REPRESENT THE PROPOSED LAYOUT. THE CONTRACTOR SHALL NOT RELOCATE EQUIPMENT OR CONDUIT RUNS WITHOUT APPROVAL FROM THE ENGINEER & SYSTEM OWNER.
5. NO CONDUCTOR OR CONNECTOR SHALL BE EXPOSED TO WEATHERING OR DIRECT SUNLIGHT OUTSIDE OF THE BOUNDARIES OF EACH SUB-ARRAY.
6. CONDUIT RUNNING BETWEEN SUB-ARRAYS SHALL BE SECURED TO THE RACKING SYSTEM VIA CONDUIT CLAMPS.
7. PROVIDE HANDHOLES / PULLBOXES AS REQUIRED TO KEEP PULLING TENSION WITHIN MANUFACTURER'S LIMITS.

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- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT · JOHN GENDRON · LICENSED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

ENLARGED EQUIPMENT AREA PLAN

Project

Date
SEPTEMBER 26, 2024

Scale
NTS

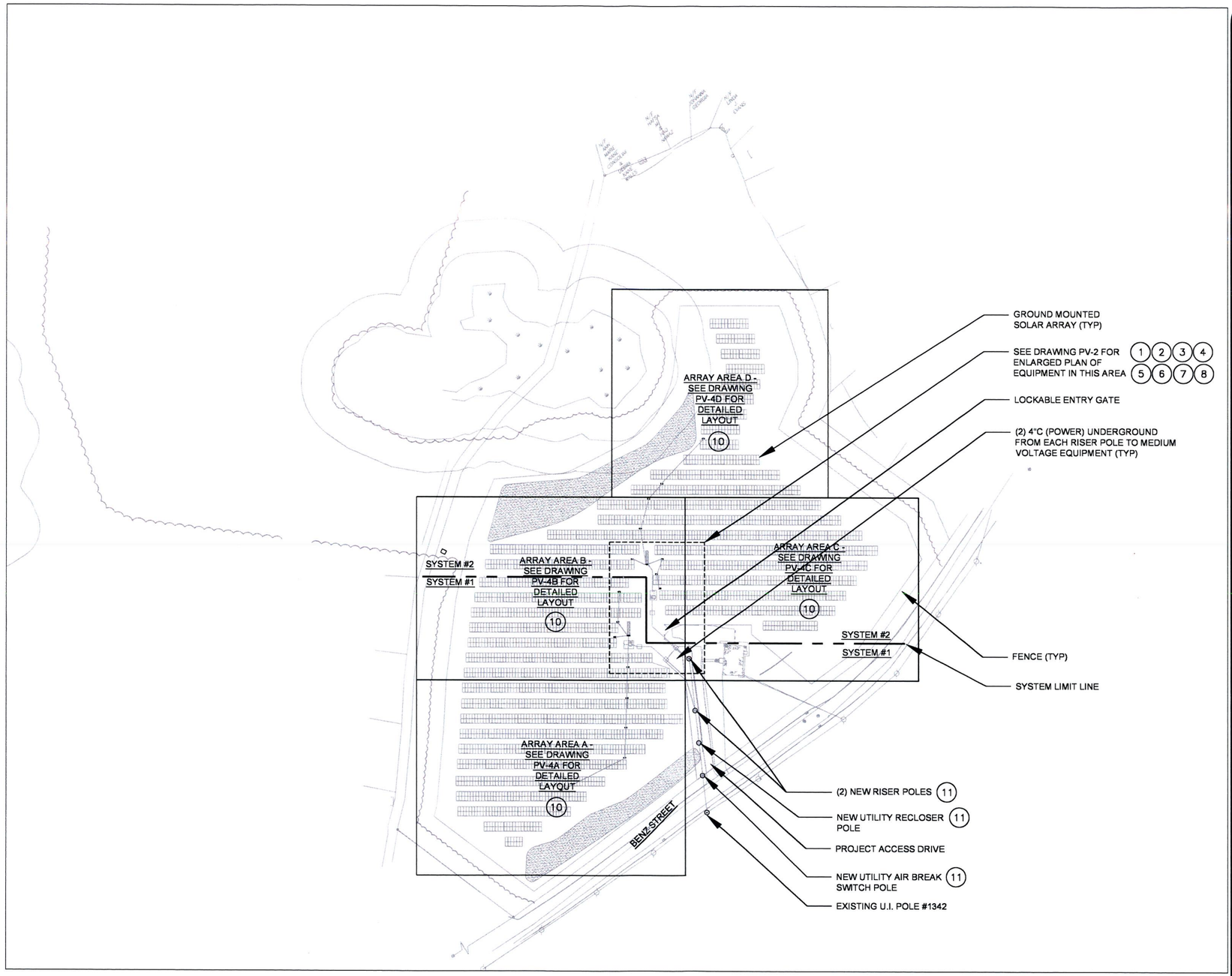
Sheet
PV-2

GENERAL NOTES

1. WORK INCLUDES INSTALLING PROPOSED SOLAR PANEL ARRAY PER THE MANUFACTURERS' INSTALLATION PROCEDURES AND INSTRUCTIONS, ALONG WITH ASSOCIATED ELECTRICAL WIRING.
2. WORK AREAS SHALL BE MARKED, FENCED, AND OTHERWISE SECURED SO AS TO PROVIDE PROPER PROTECTION FOR THE PUBLIC AND AS REQUIRED BY THE BUILDING INSPECTOR.
3. THE CONTRACTOR SHALL NOT DEVIATE FROM THE LAYOUT SHOWN WITHOUT APPROVAL FROM THE ENGINEER.
4. ELECTRICAL RUNS SHOWN ON PLAN REPRESENT THE PROPOSED LAYOUT. THE CONTRACTOR SHALL NOT RELOCATE EQUIPMENT WITHOUT APPROVAL FROM THE ENGINEER & SYSTEM OWNER.
5. NO CONDUCTOR OR CONNECTOR SHALL BE EXPOSED TO WEATHERING OR DIRECT SUNLIGHT OUTSIDE OF THE BOUNDARIES OF EACH SUB-ARRAY.
6. CONDUIT RUNNING BETWEEN SUB-ARRAYS SHALL BE SECURED TO THE RACKING SYSTEM VIA CONDUIT CLAMPS.
7. PROVIDE HANDHOLES / PULLBOXES PER CODE.

KEY NOTES

1. DC DISCONNECTS MOUNTED TO STRUT AT EACH INVERTER RACK / HUT.
2. PAD MOUNTED CUSTOMER OWNED RECLOSERS.
3. INVERTERS 1 THROUGH 16 MOUNTED TO STRUT RACKS / HUTS.
4. PAD MOUNTED SWITCHBOARDS WITH AC COMBINERS.
5. PAD MOUNTED UTILITY COMPANY PRIMARY METERING ENCLOSURES WITH ADJACENT STRUT MOUNTED UTILITY REVENUE METERS & REC METERS.
6. PAD MOUNTED CUSTOMER OWNED TRANSFORMERS.
7. AUXILIARY POWER CENTER MOUNTED TO STRUT RACK.
8. SYSTEM OWNER'S METERING & MONITORING SYSTEMS (MULTIPLE COMPONENTS) MOUNTED TO STRUT RACKS.
9. NOT USED.
10. DC COMBINER BOXES MOUNTED TO ARRAY RACKING STRUCTURES - SEE PV-4X DRAWINGS5 FOR EXACT LOCATIONS.
11. COORDINATE EXACT LOCATIONS OF UTILITY POLES WITH U.I. IN THE FIELD.



1 / PV-3 OVERALL SITE ELECTRICAL PLAN
1" = 80'-0"

Project Info

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PREPARED FOR:

ecos ENERGY
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MINNEAPOLIS, MN 55402
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TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):
- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT · BRYAN GARDINER · 31583 · LICENSED · PROFESSIONAL ENGINEER

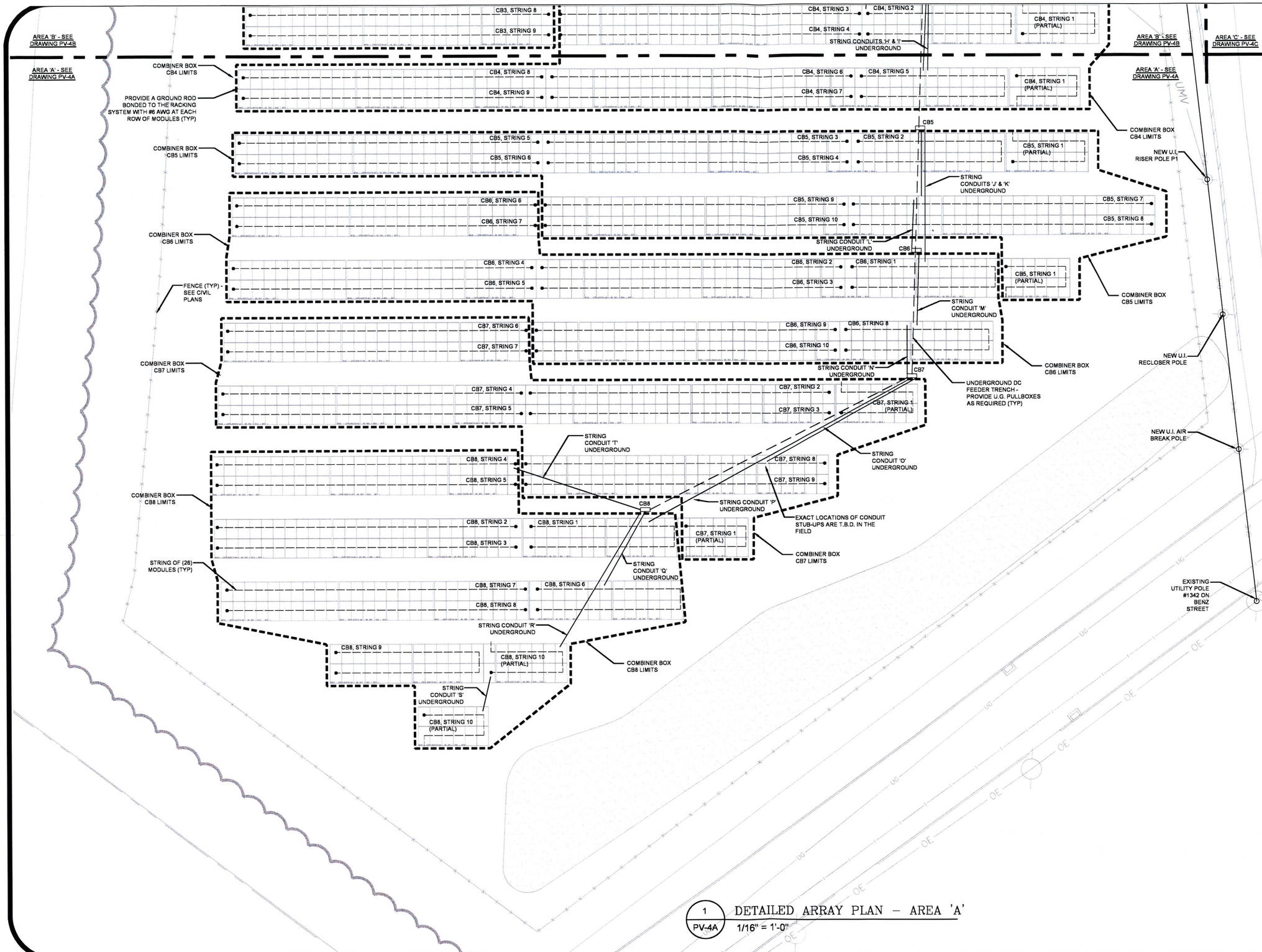
No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

OVERALL SITE ELECTRICAL PLAN

Project
Date: SEPTEMBER 26, 2024
Scale: 1" = 80'-0"
Sheet: PV-3



1 / PV-4A DETAILED ARRAY PLAN – AREA 'A'
1/16" = 1'-0"

Project Info

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TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
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- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT
SUPREME GENERAL
LICENSED
PROFESSIONAL ENGINEER

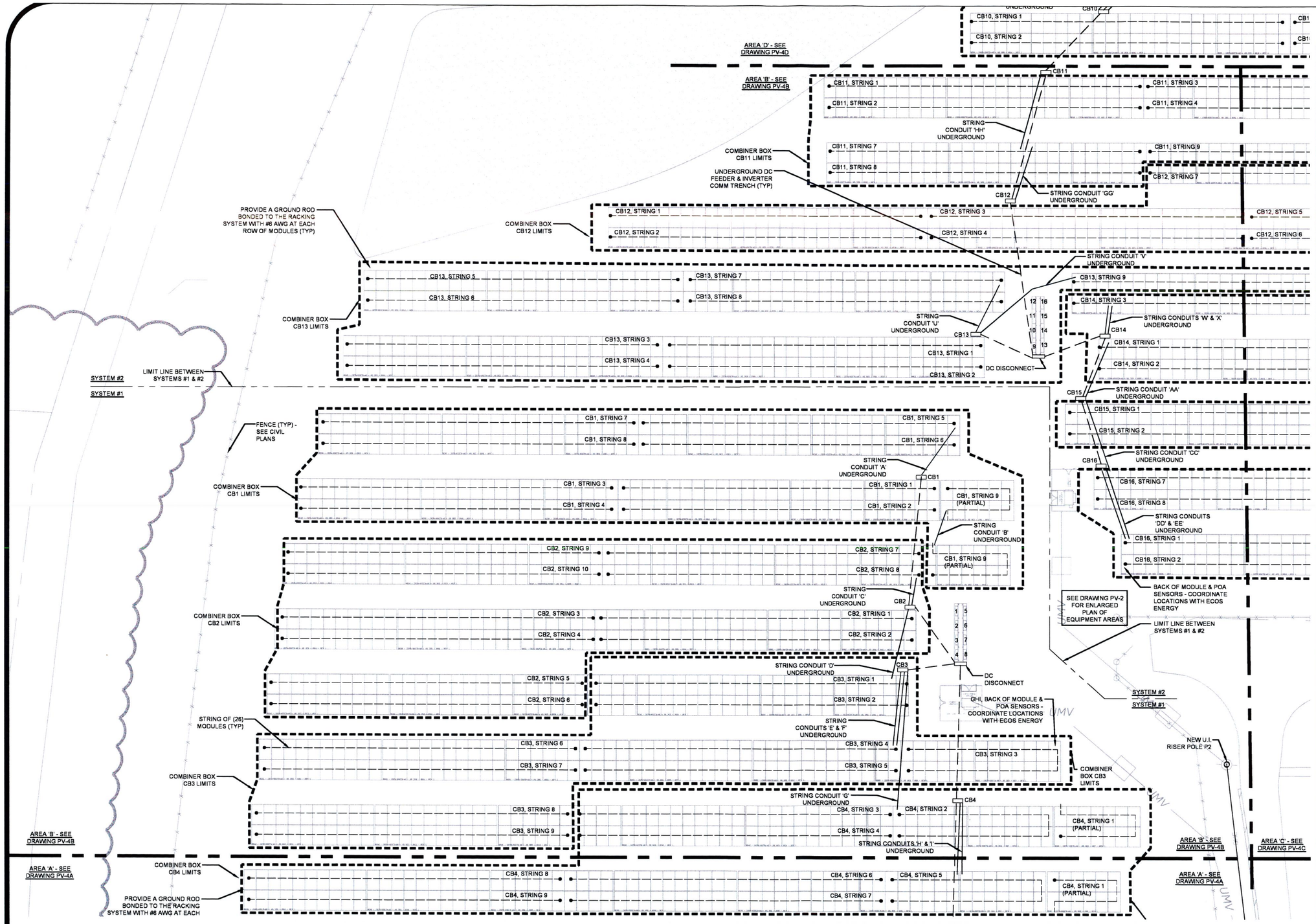
No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

DETAILED ARRAY PLAN - AREA A

Project	Sheet
Date: SEPTEMBER 26, 2024	PV-4A
Scale: 1/16" = 1'-0"	



1 / PV-4B DETAILED ARRAY PLAN – AREA 'B'
1/16" = 1'-0"

Project Info

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TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT · BRIAN C. GERARDI · LICENSED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

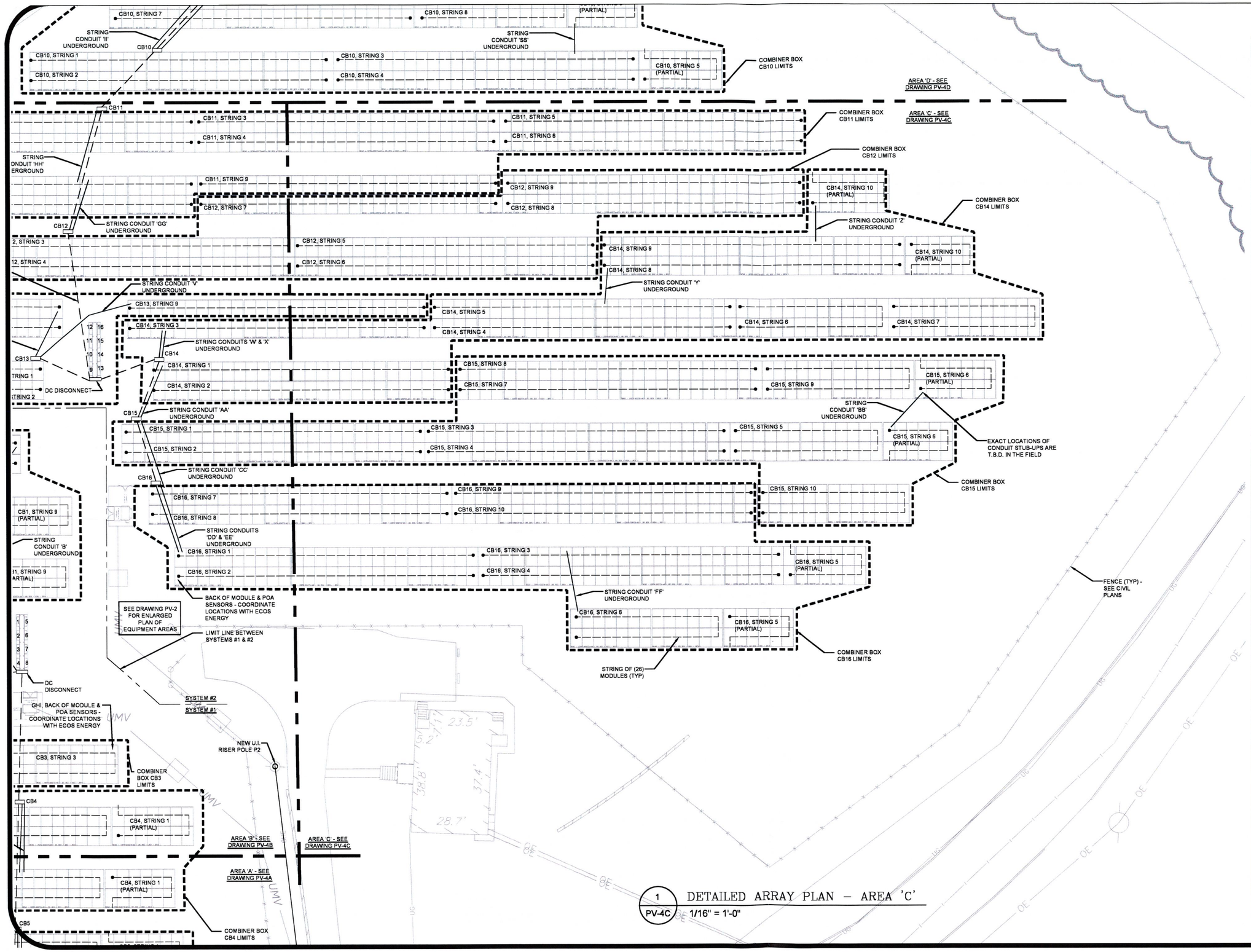
DETAILED ARRAY PLAN - AREA B

Project

Date
SEPTEMBER 26, 2024

Scale
1/16" = 1'-0"

Sheet
PV-4B



1 PV-4C DETAILED ARRAY PLAN – AREA 'C'
1/16" = 1'-0"

Project Info

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TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT
BRIAN GENDRON
LICENSED
PROFESSIONAL ENGINEER

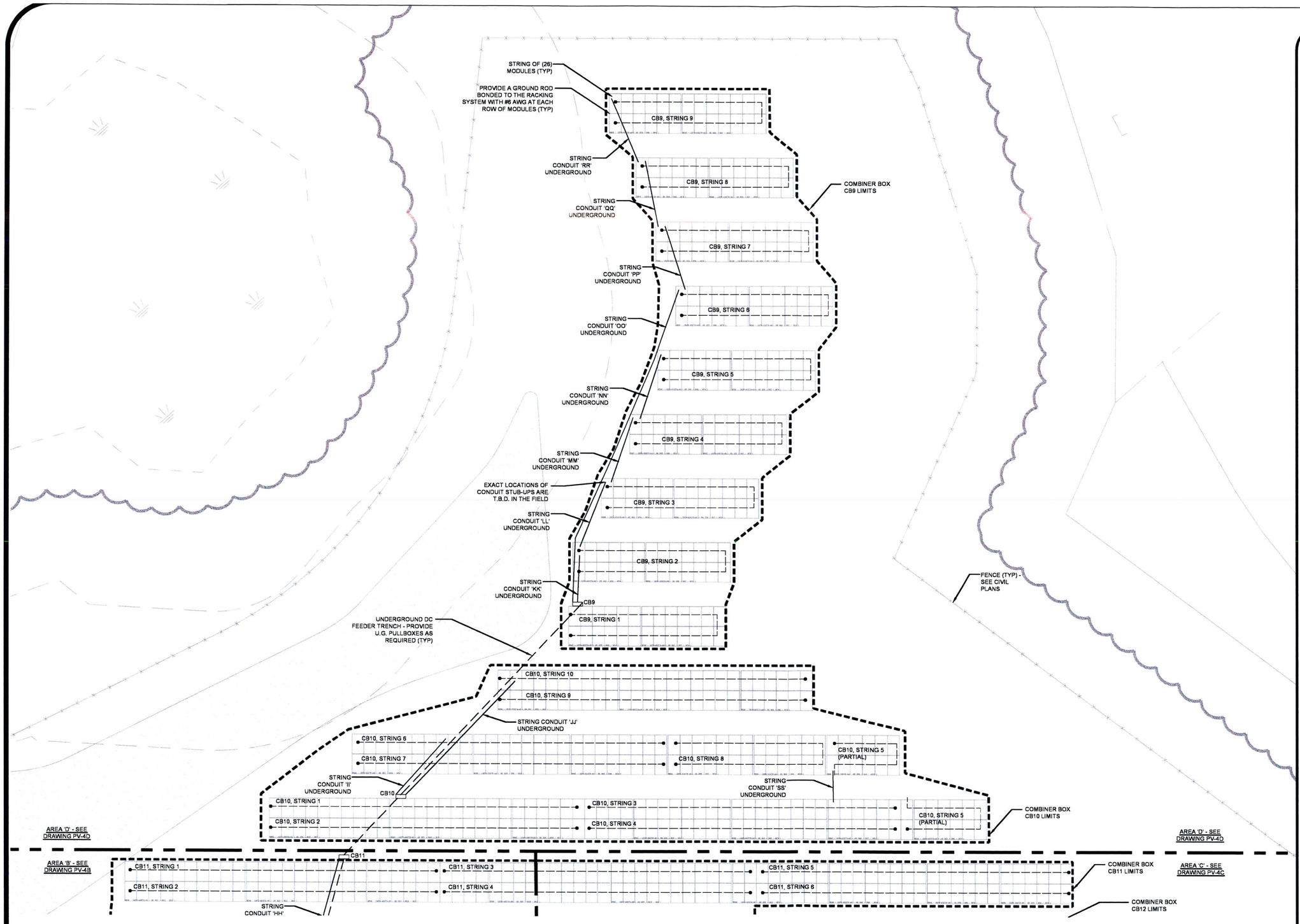
No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

DETAILED ARRAY PLAN - AREA C

Project	Sheet
Date: SEPTEMBER 26, 2024	PV-4C
Scale: 1/16" = 1'-0"	



1 / PV-4D DETAILED ARRAY PLAN – AREA 'D'

1/16" = 1'-0"

Project Info

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TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT
JASON GERDREA
LICENSED
PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

DETAILED ARRAY PLAN - AREA D

Project

Date
SEPTEMBER 26, 2024

Scale
1/16" = 1'-0"

Sheet
PV-4D

SECTION 16010 - GENERAL PROVISIONS - ELECTRICAL

A. The work included under Division 16 shall consist of furnishing labor and materials necessary for the complete installation of lighting, power, and photovoltaic systems shown on the drawings. All work shall be complete and left in operating condition at completion of Contract.

B. Include minor items that are obviously and reasonably necessary to complete the installation and usually included in similar work. Such items include bolts, nuts, anchors, brackets, sleeves, and minor offsets in conduit, junction boxes, etc.

C. Some equipment and materials provided under other divisions may require composite work crews because of trade jurisdiction. It is the Contractor's or Subcontractor's responsibility to review all Contract Documents to determine where these composite crews are required.

D. All temporary and permanent permits and licenses required in connection with this Division's work shall be the responsibility of the Contractor awarded that work.

E. Installation shall meet or exceed current applicable codes, ordinances and regulations in effect at the site. If a Contractor or Subcontractor observes that the Contract Documents are at variance with governing codes and regulations, they shall promptly notify the Engineer in writing, who will respond to such variances in writing. If the Contractor performs work knowing it is not compliant with applicable codes, and does not notify the Engineer, the Contractor shall assume full responsibility and bear all costs attributable to correcting the non-complying work.

F. The reference to Codes and Standards shall not permit a lower grade of construction where Contract Documents call for workmanship and/or materials in excess of those references.

G. Where the terms "provide" or "shall be" are used in this Division or on the drawings, they shall be taken to mean "The Contractor shall furnish and install".

H. If equipment or materials other than those specified in the design of this project are proposed to be used on this project, the Contractor and supplier shall check it for dimensional differences, electrical requirements and any other potential variances. This comparison shall be made for manufacturers specified as well as those proposed prior to requesting approval. The Contractor shall be responsible for any extra costs incurred as a result of Substitutions, including those of other contractors, such as might be due to (but not limited to) different electrical, mechanical and architectural requirements.

I. Shop Drawings:

1. Carefully examine all shop drawings noting capacity, arrangement and physical dimensions and mark the drawings as being reviewed and approved prior to submitting to the Engineer. Where catalog data is submitted which includes items which do not apply to this project, those items shall be clearly marked out or relevant items clearly noted. Any deviations from the documents shall be so noted by the Contractor or equipment supplier. The intent and requirements of the drawings and specifications shall be adhered to at all times and are not waived or superseded in any way by the shop drawing submittal or review.
2. Submit a minimum (1) electronic copy of shop drawings for review and approval. Contractor shall retain a final approved copy for incorporation in the Operation and Maintenance Manuals.
3. If returned shop drawings are marked "NO EXCEPTIONS TAKEN", no additional submittal is required. If the shop drawing is marked "MAKE CORRECTIONS NOTED", the changes noted on the shop drawings are to be incorporated, with no further resubmittal required. If marked "REVISE AND RESUBMIT", changes noted on the shop drawings are to be made and the drawings resubmitted for review. If marked "REJECTED", the equipment submitted is unacceptable and different equipment or materials need to be submitted.

J. No asbestos or PCB containing materials of any type shall be used on this Project.

K. Consult the Contract Drawings and Specifications of all other Divisions and other trades for correlating information and layout work so that it will not interfere with other trades. Verify all dimensions and conditions. If conflicts occur such that resolution is not possible by the affected trades on the job, the Engineer shall be notified and a resolution will be worked out.

L. Electrical equipment enclosures (switchboards, panelboards, transformers, relay cabinets, systems racks/cabinets, combiner boxes, etc.) shall be vacuumed and wiped clean prior to energizing and again at substantial completion.

M. Install material and equipment in accordance with Manufacturers' recommendations, instructions, and current N.E.C.A. standards.

N. Install equipment and materials to provide required access for servicing and maintenance. Coordinate final equipment location with required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

O. Record Drawings: As work progresses, in a neat and legible manner, record all changes or deviations from the contract drawings. Submit Record Drawings to Engineer for review at completion of Work. The Record Drawings will become part of the Operation and Maintenance Manual package submitted to the Owner after the completion of the project.

SECTION 16050 - BASIC MATERIALS AND METHODS

A. All materials shall be new, as specified or approved, and in original packaging. Catalog numbers specified shall be verified with vendors prior to ordering material.

B. All materials shall be listed by a NRTL (i.e. UL, ETL, etc.) and have an associated label unless special fabrication of material is required. Special fabricated material shall be fabricated using listed components and procedures.

C. Where the word "provide" is used, it shall require the electrical subcontractor to furnish and install material complete to a workable system.

D. All work shall be tested in accordance with industry accepted standards. Before testing, a thorough visual inspection shall be made to detect connection problems, damaged components, poor workmanship, inappropriate overcurrent protection, debris, etc. Testing apparatus shall be certified or demonstrated to be accurate within reasonable limits. Competent personnel familiar with the test equipment shall perform all tests. If testing procedures employed are not satisfactory to the Engineer, outside testing will be done at the electrical subcontractor's expense.

E. Electrical subcontractor to identify all electrical equipment with engraved 1/4" white letters on black plates. Inscriptions shall indicate the name, voltage, phase, wires, feeder size, feeder source and location of source, and the device number.

F. All low voltage cables shall be bundled and labeled as to their function within terminal cabinets, wireways and cable trays.

G. Branch circuitry shall match circuit numbers as shown on the drawings and as scheduled. Any required deviation shall be indicated on the as-built drawings.

H. All opening into equipment shall be sealed to prevent entry of insects and rodents.

SECTION 16110 - RACEWAYS

A. Construction shall be as per Underwriter's Laboratories Standard UL 870 for wireways, auxiliary gutters and associated fittings.

B. Wireways shall be painted steel with hinged removable cover, which can be used as either a hinged cover or set screw cover. Shall be fabricated such that the entire length of wireway and fittings permit lay-in wiring application. Cross sectional area shall be 6" x 6" minimum unless otherwise noted. Raintight wireway shall be NEMA 3R construction with gaskets and a corrosion resistant finish.

C. Where required, provide cable strain relief, grounding connectors, expansion fittings.

D. Schedule 40 PVC shall be used for all raceways where not restricted by this section or specifically noted otherwise. Schedule 80 PVC shall be used where above ground or transitions where emerging from ground and exposed to physical damage.

E. PVC conduit used above grade shall be UV resistant type.

F. Flexible liquid tight conduit shall be used on all motor, moving, and vibrating equipment connections. Use minimum 1/2" size with grounding type fittings and provide grounding conductor.

G. Conduit shall not be mounted on mechanical or other equipment which vibrates except at connection points.

H. Installations of underground wiring shall be in trench, duct or conduit or by plowing in place as specified on plans.

I. Underground raceways shall be installed to meet the following requirements:

1. Spacing between exterior surfaces of underground conduits shall be not less than the following:
   a. 2 inches between communications (copper) conduits.
   b. 2 inches between AC conduits operating at not over 1000 volts
   c. 6 inches between a communications conduit and any power conduit/cable (AC or DC not over 1000V) in the same trench
   d. 12 inches between a communications conduit and any power conduit (AC or DC over 1000V) in the same trench, unless noted otherwise
   e. 6 inches between AC conduits operating at over 1000 volts
   f. 6 inches between AC power conduits and DC power conduits/cables.
   g. 6 inches between armored fiber optic cable or in metallic conduit and power conduits/cables (AC or DC)
2. Where crossing perpendicular, spacing between exterior surface of underground conduits shall be not less than the following:
   a. 6 inches between AC and DC power conduits operating at any voltage.
   b. 12 inches between conduits/cables containing AC and DC power conduits operating at any voltage and communications (copper) conduits

J. All underground raceways when specified in excavated trenches shall have backfill compacted. Refer to compaction requirements in trench compaction details. Backfill immediately **around conduits/conductors to be a minimum of 3" native soil free from debris and organic material.**

Thermal conductivity of imported backfill shall be tested in accordance with ASTM D5334-08 to confirm the thermal resistively is equal to or less than that of the native soil or, if applicable, the specific requirements on these plans.

K. Underground conduit shall be installed to allow drainage into manholes/handholes a minimum of 4 inches per 100 feet of horizontal run. Where conduits or ducts enter a manhole, handhole, or above grade cabinet, each shall be permanently identified by means of plastic fiber, laminated plastic or non-corrosive metal tags to indicate origination point.

L. When non-metallic conduit requires field bending, utilize a hot-bending appliance. Use of torches to bend conduit is unacceptable.

M. Where conduits terminate in handholes/vaults or in pad mounted equipment, terminate conduits a minimum of 4 inches above bedding or slab. Conduits shall use bell ends. Where routed through slabs, provide sleeves to allow settling/heaving of slab.

N. Where HDPE innerduct is used, Schedule 40 PVC or Schedule 80 PVC (where subject to damage) conduit shall be used for transitions to above grade.

SECTION 16120 - WIRING AND CABLE

A. Building Wire:

1. Description: Single conductor insulated wire.
2. Conductor: 98% Commercially pure copper conductors or AA-8000 series aluminum alloy compact stranded conductors
3. Insulation Voltage Rating: 600 volts and 2000 volts
4. **Insulation: ANSI/NFPA 70, 90° C Type THHN-2, THWN-2, XHHW-2, RHW-2, USE-2, and PV**
5. Exposed PV module wiring and combiner box feeders shall be 2000 volt tray rated PV type.
6. 600V AC wiring installed below grade shall be type XHHW-2, RHW-2, or USE-2.

C. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

D. Neatly trim and lace wiring inside boxes, equipment, and panelboards.

E. Clean conductor surfaces before installing lugs and connectors.

F. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.

G. Parallel 3-phase feeder runs in conduit shall have all three phase conductors (including neutral and ground where required) installed in each conduit. Grouping a single phase (or two phases) in a single conduit is not permitted.

H. Identification:

1. Control wiring shall be marked at both ends as to its function.
2. Spare conductors shall be identified as such.

SECTION 16125 - MEDIUM VOLTAGE CABLES

B. Cables for the **13.8kV** system shall be UD **15 kV** MV-105 Listed single conductor, insulated, shielded and jacketed medium voltage type power cable with 100% insulation level, 105° C continuous operation rating, 130° C emergency rating, 250° C short circuit rating.

C. Cable shall have ASTM B-609 aluminum conductors with Class B stranding in accordance with ASTM B-231, moisture blocked strands, an extruded semi-conducting shield layer (40 mil min.) over the conductor for stress control, direct-burial XLPE insulation (045 mils min.), a concentric copper neutral, and moisture/chemical/oil/flame resistant PVC jacket.

D. Cables shall be Manufactured by Okonite, Prysmian, Southwire, General Cable, WTEC, or approved equal.

E. All MV cables must use cable termination kit manufactured by 3M, TE Connectivity, Eaton/Cooper, or Richards.

F. Complete installation shall be per National Electrical Code Articles 310 and 328. Do not exceed manufacturer's published maximum pulling tension or sidewall pressure. Provide sufficient slack in cable, ground and drain wires to permit elbow connectors to be moved to their respective parking stands.

G. All cables shall be labeled at each end at an accessible location for viewing. Label shall indicate circuit, phase, and destination/origination. Labels shall be black phenolic with white lettering and secured with a minimum of (2) UV-resistant zip ties.

H. Splices and terminations shall be made by an experienced journeyman whose qualifications are subject to approval by the Engineer. No splices shall be allowed unless specifically noted. No underground splices are permitted. Fiberglass splice boxes are not permitted unless approved by owner. All splices to be approved by owner.

I. Arrange phases at termination points, A-B-C from left to right or top to bottom as viewed from the front.

J. Test all cables according to IEEE Standard 400. Each power cable over 1000V shall be given a continuity test, and each medium voltage cable shall be given a continuity and a VLF test after installation and after terminations having been made. All single conductor cables shall be tested between conductors and ground with metallic shield and the other two conductors grounded to the same ground. Each conductor shall be successively tested in the same manner. Direct current voltages shall be applied with negative polarity to the cable conductor. See testing procedures as required.

K. No cable shall be permanently energized until a copy of its test record is approved by the Engineer.

L. In addition to any testing specified herein, perform testing consistent with the requirements of the applicable codes, NETA Acceptance Testing criteria, and the manufacturers' current quality assurance program.

SECTION 16130 - BOXES

A. Pull and junction boxes shall be code gauge, gasketed, painted, galvanized steel, PVC, or fiberglass. Covers shall be secured with screws.

B. Outlet boxes shall be cast malleable iron with threaded hubs or PVC and be of high conductive metal to maintain maximum electric continuity.

C. All outlets shall be equipped with outlet boxes approved for the use.

D. Covers or plates for boxes shall conform substantially to the outlet of the boxes with no projecting edges or corners.

E. Conduit fittings ("LB", "C", "T") or types approved for the location may be employed as required to facilitate pulling in conductors.

F. Provide pull and above ground junction boxes to facilitate pulling or splicing of conductors.

G. Mount boxes to allow for maximum flexibility.

H. Install grounding bushings with bonding conductor on all metallic feeder conduits entering box. Ground bushings and bonding conductors are not required on branch circuit conduits.

SECTION 16340 - MEDIUM VOLTAGE SECTIONALIZING CABINETS/MEDIUM VOLTAGE JUNCTION BOXES

A. Sectionalizing cabinets shall be designed for burial with the junction modules mounted above the ground line. Pedestals shall be in complete conformance with ANSI C57.12.28, Pad-mounted Equipment Enclosure Integrity Standard.

B. Sectionalizing cabinets shall be Manufactured by Nordic, Cooper, Hubbell, G&W, Power Design Inc., Highline, Federal Pacific, Hoffman, S&C or approved equal.

C. Enlosure shall be 3/16" nominal thickness fire resistant, laminate, fiberglass, with munsell green gel coat finish or shall be 12 gauge galvanized steel, with munsell green polyester powder coat finish. Enclosure access doors shall utilize stainless steel hinges and shall have provisions for padlocking. Doors shall have provisions for securing in the open position.

D. Provide junction panels with bushings to accommodate the size and quantity of dead break elbows indicated on drawings.

E. Provide ground bar in unit for bonding of ground conductors and concentric neutrals.

F. **Provide fiberglass ground sleeve extending 36" below cabinet installed on a 6" pea rock base to** allow drainage.

SECTION 16440 - DISCONNECT SWITCHES

A. All disconnect switches shall be NEMA heavy duty Type H.D., horsepower rated, and U.L. listed. Disconnects shall be Eaton, GE, Square D, Siemens or approved equal.

B. Provide auxiliary disconnect contacts for control circuits when supplied from an independent source.

C. Switch Interior - All switches shall have switch blades which are fully visible in the off position when the door is open. Switches shall be of dead-front construction with permanently attached arc suppressors hinged or otherwise attached to permit easy access to line-side lugs without removal of the arc suppressor. Lugs shall be UL listed for copper and/or aluminum cables and front removable. All current carrying parts shall be plated by electrolytic processes.

D. Switch Mechanism - Switches shall have a quick-make and quick-break operating handle and mechanism which shall be an integral part of the box, not the cover. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door in the ON position or closing of the switch mechanism with the door open. Switches shall provisions for locking the switch in both the ON and the OFF positions by padlock.

E. Enclosures shall be NEMA 3R enclosures unless otherwise specified. Raintight covers shall be securable in the open position. Enclosures shall be code gauge (UL 98) galvanized steel (NEMA 3R). They shall be treated with a rust-inhibiting phosphate and finished in gray baked enamel.

F. Install disconnect switches in an accessible location as convenient as possible to equipment served.

G. Switches shall be rated for the voltage and system type they are used for.

SECTION 16450 - GROUNDING

A. Provide complete grounding systems as described herein and as shown on the drawings.

B. All grounding components shall be listed for the purpose they are installed for. Components shall be Manufactured by AMPACT, Burndy, CADWELD, ITT Blackburn, Ilsco or Lyncole.

C. Ground rods shall be 3/4 inch diameter by 10 feet long copper clad steel. Connecting cables shall be copper as indicated on drawings. All ground conductors exposed to the elements or in direct contact with the earth shall be tin coated or bare copper.

D. All metallic conduits, supports, cabinets, non-current carrying parts of equipment, and metallic structures shall be solidly grounded to form a continuous permanent and effective grounded system.

E. All wireways, metal enclosures, cable trays and similar parts of the electrical installation described herein shall be grounded.

F. UFER grounds shall be via exothermically weld connection to a minimum **of (2) continuous 20'-0" sections of rebar encased in the concrete footings/piers with a minimum of 2" of concrete cover. Rebar shall be a minimum of a #4 and shall NOT be epoxy coated. If multiple pieces of rebar are required to provide the 20'-0" lengths, they shall be welded together** to provide a continuous ground path.

G. The special attention of the Contractor is called to metallic building components and mechanical piping which must be grounded in an approved manner according to the NEC.

H. Provide a continuous grounding conductor for each feeder serving several panelboards. Connect this ground conductor to each related cabinet ground bar.

I. For LVAC circuits less than 1000 VAC not supplied by cables with integral ground wire, provide a separate green insulated equipment grounding conductor for each single or three phase feeder and each branch circuit with a three phase protective device. Install the required grounding conductor in the common conduit with the related phase/hot and neutral conductors. Where parallel feeders are installed in more than one raceway, provide a green insulated equipment grounding conductor in each raceway.

J. Single Phase Branch Circuits for Lighting, Receptacles, Motors and Other Similar Equipment: Provide single phase branch circuits serving lighting, receptacles, motors, and other similar equipment consisting of phase, neutral, and green insulated equipment ground conductor installed in a common conduit.

K. Single Phase Branch Circuits for Special Equipment: Provide single phase branch circuits serving special equipment, and all branch circuits installed in nonmetallic or flexible conduits with a separate grounding conductor.

L. All transformers shall be bonded to the grounding electrode system as well as building steel (where applicable).

M. Bond all cable tray and equipment racks to ground with a minimum 4/C AWG ground conductor or as noted on plans.

N. Connections to the PV modules shall be installed such that removal of a module from the string does not interrupt the grounded conductor to another string. Sets of modules connected in series rated at 50 volts or more with or without blocking diodes, and having a single overcurrent device shall be considered a string.

O. When required by the testing plan, the resistance to earth shall be measured using a 3-point fall of potential test with the inverter station ground grid isolated. Results shall be compared to grounding model/study to verify field measured earth resistance is within the same order of magnitude as the grounding model/study.

SECTION 16475 - FUSES

A. DC fuses for PV string circuits shall be 1500Vdc rated HP15M as Manufactured by Mersen.

B. DC fuses for PV feeders shall be Class J or gPV type as Manufactured by Bussman, Mersen, or Littelfuse.

C. Fuses in switchboard, 601A and larger shall be Class L type and be Bussman Class L, Limitron KTU (or Hi Cap KRP-C), CEFCO Class L, CLL, Ferraz Shawmut Class L, Amp Trap A4BY, or Littelfuse Class L, KLP-C.

D. Fuses for feeder circuits 600A and less shall be Class RK1 and be Bussman Low Peak LPN-RK (250V) or LPS-RK (600V), CEFCO Lo-Ip LDN-RK (250V) or LOS-RK (600V); Ferraz Shawmut Amp-Trap II A2D-R (250V) or A6D-R (600 V), or Littelfuse Little Peak LLN-RK (250V) or LLS-RK (600V).

E. Fuses for motor circuits shall be Class RK5 type and be Bussman Fusetron FRN-R (250V) or FRS-R (600 V); CEFCO CEFCON CRN-R (250V) or CRS-R (600V); Ferraz Shawmut Trionic TR-R (250 V) or TRS-R (600 V); or Littelfuse Slo-Blo FLN-RL (250V) or FLS-R (600V).

F. For in-line fuses and weatherproof assembly, provide Bussman Tron Type HEB fuse holder and Type KTK fuse with TA0511 boot or equal.

G. For protection of control circuit transformers, provide Bussman Type FNQ time delay fuses or equal.

H. **Install fuses to allow viewing of "Blown-Fuse" indicators through viewing windows in gear, where** provided.

I. Provide label inside each switch and motor starter cover stating type of fuse required for replacement.

SECTION 16630 - COMBINER BOXES

A. Provide 1500V combiner box(s) Listed to UL 1741; complete with circuitry as necessary to protect the equipment including disconnect switch with finger-safe fuse holders having all necessary fusing. Combiner boxes shall be Eaton/Cooper, Shoals, SolarBos, Amtec, Teal, Bertek, WTEC, or approved equal.

B. A finger safe, non fused load break disconnect is required and it shall be interlocked to prevent the opening of the cover when the switch is in the ON position. Interlock shall be defeatable for testing purposes. Handle must be lockable in OFF position.

C. All fuse holders shall be finger-safe.

D. The combiner box shall be arranged to have a minimum number of input circuits and fuse sizes as indicated on the combiner box schedules for a negatively grounded system. Input fuse holders shall be rated to hold 32A fuses.

E. Enclosures shall be a minimum of NEMA 3/IP54 with seamless door gaskets and an integral disconnect rated as indicated on the combiner box schedules.

F. **All wire terminations/lugs shall be Listed for 90°C field terminations.**

G. Combiner boxes including disconnect and fuses shall be Listed for continuous operation at 100% of its collector bus/disconnect rating.

H. Provide units with integral DC surge protection devices rated for 40kA discharge current (8/20 µs) and maximum continuous operating voltage of 1500Vdc.

I. Equipment shall have a nameplate installed and mounted to the front cover and indicate, at a minimum: number of input circuits, ampere rating of input circuits, voltage rating, short circuit current rating, and integrated disconnect ampere rating.

J. Combiner box Manufacturer shall review combiner box schedules and verify combiner boxes enclosures are large enough and configured to allow termination of the size and quantity of string and feeder conductors/conduits indicated on the schedules.

K. Provide typed PV string directory inside cover to denote strings and their associated fuse/terminal number.

L. All combiner box components shall be pre-wired before arriving to site.

M. Provide a directory of combiner boxes at each inverter to facilitate location and shut down of DC sources.

SPEC IS FROM SIMILAR ECOS ENERGY PROJECT

SOLAR PV GENERAL NOTES

1. INSTALL A COMPLETE AND OPERATIONAL SOLAR PHOTOVOLTAIC SYSTEM.
2. THESE DRAWINGS ARE DIAGRAMMATIC AND SHOW THE GENERAL LOCATION AND ARRANGEMENT OF THE SOLAR PV SYSTEM. THEY DO NOT SHOW ALL MATERIALS NEEDED. CONTRACTOR IS REQUIRED TO PROVIDE ANY AND ALL CONDUITS, CONNECTORS, SWEEPS, SUPPORTS, BENDS, FITTINGS, HANGERS, COVER PLATES, AND ADDITIONAL PULL AND JUNCTION BOXES WHICH THE CONTRACTOR MUST PROVIDE TO COMPLETE THE SOLAR PV SYSTEM IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC).
3. THE DEFINITION OF ELECTRICAL TERMS USED SHALL BE AS DEFINED IN THE STATES' ADOPTED EDITION OF THE NEC.
4. THE TERM "SIZE" SHALL MEAN ONE OR MORE OF THE FOLLOWING: "LENGTH, CURRENT AND VOLTAGE RATING, NUMBER OF POLES, NEMA SIZE, AND OTHER SIMILAR ELECTRICAL CHARACTERISTICS".
5. CONTRACTOR IS REQUIRED TO SURVEY AND INSPECT ALL AREAS PRIOR TO PERFORMING SERVICES TO ENSURE CLEARANCES CAN BE MET AND NO INTERFERENCES EXIST. NO CUTTING OR DRILLING IS TO BE PERFORMED PRIOR TO LOCATING EXISTING STRUCTURAL MEMBERS AND UTILITIES.
6. SERVICE ENTRANCE RATED EQUIPMENT, CT CABINETS, AND METER SOCKETS ARE TO BE APPROVED FOR USE BY THE LOCAL UTILITY COMPANY.
7. ELECTRICAL EQUIPMENT INSTALLED MUST BE LABELED, UL LISTED, AND INSTALLED ACCORDINGLY.
8. REQUIRED PERMITS AND INSPECTIONS ARE THE RESPONSIBILITY OF THE CONTRACTOR AND MUST BE COORDINATED WITH THE AUTHORITY HAVING JURISDICTION (AHJ).
9. ALL WORK IS TO BE PERFORMED BY LICENSED & QUALIFIED WORKERS AND COMPLETED IN ACCORDANCE WITH THE STATES' ADOPTED NEC.
10. THE SOLAR PV SYSTEM EQUIPMENT ON THE DC SIDE IS RATED FOR 1500V AND IS IN COMPLIANCE WITH THE NEC. THE INVERTERS, MODULES, STRING FEEDERS, AND RELATED COMPONENTS ARE ALL RATED AND LABELED AS 1500V OR GREATER.
11. CONTRACTOR SHALL SUBMIT A FORMAL RFI (REQUEST FOR INFORMATION) FOR ANY CONFUSION OR DISCREPANCY ON THE DRAWINGS. CONTRACTOR IS RESPONSIBLE FOR ANY INSTALLATION DEVIATIONS WITHOUT APPROVAL FROM SYSTEM OWNER OR THE ENGINEER OF RECORD.
12. ALL SUPPORTS, BOLTS, STRAPS, AND SCREWS SHALL BE CORROSION RESISTANT.
13. APPLY AN ADHESIVE LABEL ON RACEWAYS ACCORDING TO THE DETAIL SHEET.
14. ALL METALLIC CONDUITS SHALL HAVE BOND BUSHINGS ON BOTH ENDS AND EQUIPMENT GROUNDING CONDUCTORS (EGC) ROUTED THROUGH CONDUIT.
15. BARE COPPER GROUND CONDUCTORS SHALL BE SIZED PER NEC. EQUIPMENT GROUNDING CONDUCTORS (EGC) SHALL BE INSTALLED IN CONDUIT PER NEC 690.43(C).
16. ALL CONDUCTORS SHALL BE LISTED FOR USE IN APPROPRIATE RACEWAY.
17. ALL BREAKERS AND EQUIPMENT INSTALLED AS PART OF THE NEW SOLAR PV SYSTEM MUST BE RATED FOR REVERSE FEED.
18. COMMUNICATIONS CABLES INSTALLED BETWEEN MONITORING EQUIPMENT AND NETWORK EQUIPMENT (SWITCHES, ROUTERS, SERVERS, ETC.) SHALL HAVE A GREEN OUTER JACKET. CABLES SHALL HAVE CABLE TAGS INSTALLED AT BOTH ENDS OF CABLE TO SHOW PROPER IDENTIFICATION.
19. CONTRACTOR SHALL TORQUE TEST ALL FIELD TERMINATED WIRES PER MANUFACTURER'S SPECS AND PROVIDE PERMANENT MARKINGS ACROSS THE BOLT AND WASHER INDICATING ACHIEVED TORQUE.
20. POLARIS SPLICES SHALL NOT BE USED ON THIS PROJECT.

Project Info

PREPARED BY:

SG ENGINEERING LLC
56 FOXCROFT COURT
SOUTHINGTON, CT
SGEDESIGN.COM
sge@sgedesign.com

PREPARED FOR:

ecos ENERGY
222 S 9TH STREET, SUITE 1600
MINNEAPOLIS, MN 55402
ECOSRENEWABLE.COM

TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT · LICENSED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

SPECIFICATIONS

Project	Sheet
Date: SEPTEMBER 26, 2024	PV-5
Scale: NTS	

STRING WIRE SCHEDULE

Inverter	String ID	Qty of Modules	Module (W-DC) STC	Total (kW-DC) STC	Approx 1-Way Length (ft)	Conductor Size (AWG) Type PV	Voltage Drop (%)
1	1-1	26	685	17.81	135	#10	0.71%
1	1-2	26	685	17.81	140	#10	0.74%
1	1-3	26	685	17.81	250	#10	1.32%
1	1-4	26	685	17.81	255	#10	1.35%
1	1-5	26	685	17.81	160	#10	0.85%
1	1-6	26	685	17.81	165	#10	0.87%
1	1-7	26	685	17.81	270	#10	1.43%
1	1-8	26	685	17.81	275	#10	1.45%
1	1-9	26	685	17.81	175	#10	0.92%
2	2-1	26	685	17.81	135	#10	0.71%
2	2-2	26	685	17.81	140	#10	0.74%
2	2-3	26	685	17.81	250	#10	1.32%
2	2-4	26	685	17.81	255	#10	1.35%
2	2-5	26	685	17.81	270	#10	1.43%
2	2-6	26	685	17.81	280	#10	1.48%
2	2-7	26	685	17.81	160	#10	0.85%
2	2-8	26	685	17.81	170	#10	0.90%
2	2-9	26	685	17.81	275	#10	1.45%
2	2-10	26	685	17.81	265	#10	1.40%
3	3-1	26	685	17.81	135	#10	0.71%
3	3-2	26	685	17.81	140	#10	0.74%
3	3-3	26	685	17.81	170	#10	0.90%
3	3-4	26	685	17.81	165	#10	0.87%
3	3-5	26	685	17.81	175	#10	0.92%
3	3-6	26	685	17.81	275	#10	1.45%
3	3-7	26	685	17.81	285	#10	1.51%
3	3-8	26	685	17.81	300	#10	1.58%
3	3-9	26	685	17.81	310	#10	1.64%
4	4-1	26	680	17.68	200	#10	1.05%
4	4-2	26	680	17.68	145	#10	0.76%
4	4-3	26	680	17.68	160	#10	0.84%
4	4-4	26	680	17.68	170	#10	0.90%
4	4-5	26	680	17.68	170	#10	0.90%
4	4-6	26	680	17.68	190	#10	1.00%
4	4-7	26	680	17.68	195	#10	1.03%
4	4-8	26	680	17.68	300	#10	1.58%
4	4-9	26	680	17.68	310	#10	1.63%
5	5-1	26	685	17.81	225	#10	1.19%
5	5-2	26	685	17.81	145	#10	0.77%
5	5-3	26	685	17.81	165	#10	0.87%
5	5-4	26	685	17.81	175	#10	0.92%
5	5-5	26	685	17.81	280	#10	1.48%
5	5-6	26	685	17.81	290	#10	1.53%
5	5-7	26	685	17.81	165	#10	0.87%
5	5-8	26	685	17.81	175	#10	0.92%
5	5-9	26	685	17.81	190	#10	1.00%
5	5-10	26	685	17.81	200	#10	1.06%
6	6-1	26	680	17.68	140	#10	0.74%
6	6-2	26	680	17.68	170	#10	0.90%
6	6-3	26	680	17.68	180	#10	0.95%
6	6-4	26	680	17.68	280	#10	1.48%
6	6-5	26	680	17.68	290	#10	1.53%
6	6-6	26	680	17.68	295	#10	1.55%
6	6-7	26	680	17.68	285	#10	1.50%
6	6-8	26	680	17.68	175	#10	0.92%
6	6-9	26	680	17.68	195	#10	1.03%
6	6-10	26	680	17.68	205	#10	1.08%
7	7-1	26	680	17.68	225	#10	1.19%
7	7-2	26	680	17.68	170	#10	0.90%
7	7-3	26	680	17.68	180	#10	0.95%
7	7-4	26	680	17.68	285	#10	1.50%
7	7-5	26	680	17.68	295	#10	1.55%
7	7-6	26	680	17.68	300	#10	1.58%
7	7-7	26	680	17.68	290	#10	1.53%
7	7-8	26	680	17.68	200	#10	1.05%
7	7-9	26	680	17.68	210	#10	1.11%
8	8-1	26	680	17.68	145	#10	0.76%
8	8-2	26	680	17.68	190	#10	1.00%
8	8-3	26	680	17.68	200	#10	1.05%
8	8-4	26	680	17.68	190	#10	1.00%
8	8-5	26	680	17.68	200	#10	1.05%
8	8-6	26	680	17.68	175	#10	0.92%
8	8-7	26	680	17.68	200	#10	1.05%
8	8-8	26	680	17.68	210	#10	1.11%
8	8-9	26	680	17.68	235	#10	1.24%
8	8-10	26	680	17.68	245	#10	1.29%

NOTE - ONE WAY LENGTHS OF RUN INDICATED IN THIS TABLE ARE FOR VOLTAGE DROP CALCULATION PURPOSES ONLY. CONTRACTOR SHALL FIELD VERIFY EXACT LENGTHS. IF ACTUAL LENGTHS ARE LONGER THAN INDICATED IN THIS SCHEDULE, CONTACT SOLAR DEVELOPER FOR GUIDANCE REGARDING STRING SIZING.

STRING WIRE SCHEDULE

Inverter	String ID	Qty of Modules	Module (W-DC) STC	Total (kW-DC) STC	Approx 1-Way Length (ft)	Conductor Size (AWG) Type PV	Voltage Drop (%)
9	9-1	26	685	17.81	140	#10	0.74%
9	9-2	26	685	17.81	160	#10	0.85%
9	9-3	26	685	17.81	195	#10	1.03%
9	9-4	26	685	17.81	235	#10	1.24%
9	9-5	26	685	17.81	265	#10	1.40%
9	9-6	26	685	17.81	260	#10	1.37%
9	9-7	26	685	17.81	170	#10	0.90%
9	9-8	26	685	17.81	205	#10	1.08%
9	9-9	26	685	17.81	240	#10	1.27%
10	10-1	26	685	17.81	140	#10	0.74%
10	10-2	26	685	17.81	145	#10	0.77%
10	10-3	26	685	17.81	205	#10	1.08%
10	10-4	26	685	17.81	210	#10	1.11%
10	10-5	26	685	17.81	290	#10	1.53%
10	10-6	26	685	17.81	165	#10	0.87%
10	10-7	26	685	17.81	175	#10	0.92%
10	10-8	26	685	17.81	250	#10	1.32%
10	10-9	26	685	17.81	205	#10	1.08%
10	10-10	26	685	17.81	200	#10	1.06%
11	11-1	26	685	17.81	140	#10	0.74%
11	11-2	26	685	17.81	145	#10	0.77%
11	11-3	26	685	17.81	175	#10	0.92%
11	11-4	26	685	17.81	185	#10	0.98%
11	11-5	26	685	17.81	285	#10	1.51%
11	11-6	26	685	17.81	295	#10	1.56%
11	11-7	26	685	17.81	165	#10	0.87%
11	11-8	26	685	17.81	175	#10	0.92%
11	11-9	26	685	17.81	210	#10	1.11%
12	12-1	26	680	17.68	170	#10	0.90%
12	12-2	26	680	17.68	180	#10	0.95%
12	12-3	26	680	17.68	135	#10	0.71%
12	12-4	26	680	17.68	140	#10	0.74%
12	12-5	26	680	17.68	225	#10	1.19%
12	12-6	26	680	17.68	230	#10	1.21%
12	12-7	26	680	17.68	200	#10	1.05%
12	12-8	26	680	17.68	315	#10	1.66%
12	12-9	26	680	17.68	310	#10	1.63%
13	13-1	26	680	17.68	135	#10	0.71%
13	13-2	26	680	17.68	140	#10	0.74%
13	13-3	26	680	17.68	250	#10	1.32%
13	13-4	26	680	17.68	260	#10	1.37%
13	13-5	26	680	17.68	270	#10	1.42%
13	13-6	26	680	17.68	275	#10	1.45%
13	13-7	26	680	17.68	160	#10	0.84%
13	13-8	26	680	17.68	165	#10	0.87%
13	13-9	26	680	17.68	180	#10	0.95%
14	14-1	26	685	17.81	135	#10	0.71%
14	14-2	26	685	17.81	140	#10	0.74%
14	14-3	26	685	17.81	150	#10	0.79%
14	14-4	26	685	17.81	260	#10	1.37%
14	14-5	26	685	17.81	270	#10	1.43%
14	14-6	26	685	17.81	380	#10	2.01%
14	14-7	26	685	17.81	435	#10	2.30%
14	14-8	26	685	17.81	335	#10	1.77%
14	14-9	26	685	17.81	340	#10	1.80%
14	14-10	26	685	17.81	420	#10	2.22%
15	15-1	26	680	17.68	135	#10	0.71%
15	15-2	26	680	17.68	140	#10	0.74%
15	15-3	26	680	17.68	250	#10	1.32%
15	15-4	26	680	17.68	255	#10	1.34%
15	15-5	26	680	17.68	365	#10	1.92%
15	15-6	26	680	17.68	390	#10	2.06%
15	15-7	26	680	17.68	275	#10	1.45%
15	15-8	26	680	17.68	270	#10	1.42%
15	15-9	26	680	17.68	385	#10	2.03%
15	15-10	26	680	17.68	395	#10	2.08%
16	16-1	26	680	17.68	165	#10	0.87%
16	16-2	26	680	17.68	175	#10	0.92%
16	16-3	26	680	17.68	275	#10	1.45%
16	16-4	26	680	17.68	285	#10	1.50%
16	16-5	26	680	17.68	420	#10	2.21%
16	16-6	26	680	17.68	335	#10	1.77%
16	16-7	26	680	17.68	135	#10	0.71%
16	16-8	26	680	17.68	140	#10	0.74%
16	16-9	26	680	17.68	250	#10	1.32%
16	16-10	26	680	17.68	255	#10	1.34%
TOTAL		3952		2697.240			1.12%

NOTE - ONE WAY LENGTHS OF RUN INDICATED IN THIS TABLE ARE FOR VOLTAGE DROP CALCULATION PURPOSES ONLY. CONTRACTOR SHALL FIELD VERIFY EXACT LENGTHS. IF ACTUAL LENGTHS ARE LONGER THAN INDICATED IN THIS SCHEDULE, CONTACT SOLAR DEVELOPER FOR GUIDANCE REGARDING STRING SIZING.

STRING CONDUIT SCHEDULE

LOCATION	CONDUIT SIZE	STRINGS CONTAINED
STRING CONDUIT A	1-1/2"	1-5 THRU 1-8
STRING CONDUIT B	1"	1-9
STRING CONDUIT C	1-1/2"	2-7 THRU 2-10
STRING CONDUIT D	1-1/4"	2-5 & 2-6
STRING CONDUIT E	1-1/4"	3-3 THRU 3-5
STRING CONDUIT F	1-1/4"	3-6 & 3-7
STRING CONDUIT G	1-1/4"	3-8 & 3-9
STRING CONDUIT H	1-1/4"	4-1, 4-5 & 4-6
STRING CONDUIT I	1-1/4"	4-7 THRU 4-9
STRING CONDUIT J	1-1/2"	5-7 THRU 5-10
STRING CONDUIT K	1"	5-1
STRING CONDUIT L	1-1/4"	6-6 & 6-7
STRING CONDUIT M	1-1/4"	6-8 THRU 6-10
STRING CONDUIT N	1-1/4"	7-6 & 7-7
STRING CONDUIT O	1-1/4"	7-8 & 7-9
STRING CONDUIT P	1"	7-1
STRING CONDUIT Q	1-1/4"	8-6 THRU 8-8
STRING CONDUIT R	1-1/4"	8-9 & 8-10
STRING CONDUIT S	1"	8-10
STRING CONDUIT T	1-1/4"	8-4 & 8-5
STRING CONDUIT U	1-1/2"	13-5 THRU 13-8
STRING CONDUIT V	1"	13-9
STRING CONDUIT W	1-1/2"	14-3 THRU 14-6
STRING CONDUIT X	1-1/2"	14-7 THRU 14-10
STRING CONDUIT Y	1-1/4"	14-8 THRU 14-10
STRING CONDUIT Z	1"	14-10
STRING CONDUIT AA	1-1/4"	15-7 THRU 15-9
STRING CONDUIT BB	1"	15-6
STRING CONDUIT CC	1"	15-10
STRING CONDUIT DD	1-1/4"	16-1 THRU 16-3
STRING CONDUIT EE	1-1/4"	16-4 THRU 16-6
STRING CONDUIT FF	1-1/4"	16-5 & 16-6
STRING CONDUIT GG	1-1/4"	12-7 THRU 12-9
STRING CONDUIT HH	1-1/4"	11-7 THRU 11-9
STRING CONDUIT II	1-1/4"	10-6 THRU 10-8
STRING CONDUIT JJ	1-1/4"	10-9 & 10-10
STRING CONDUIT KK	1-1/2"	9-2 THRU 9-5
STRING CONDUIT LL	1-1/4"	9-3 THRU 9-5
STRING CONDUIT MM	1-1/4"	9-4 & 9-5
STRING CONDUIT NN	1"	9-5
STRING CONDUIT OO	1-1/2"	9-6 THRU 9-9
STRING CONDUIT PP	1-1/4"	9-7 THRU 9-9
STRING CONDUIT QQ	1-1/4"	9-8 & 9-9
STRING CONDUIT RR	1"	9-9
STRING CONDUIT SS	1"	10-5

Project Info

PREPARED BY:

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SOUTHINGTON, CT
SGEDESIGN.COM
sge@sgedesign.com

PREPARED FOR:

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222 S 9TH STREET, SUITE 1600
MINNEAPOLIS, MN 55402
ECOSRENEWABLE.COM

TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT · SERGIO GENOVESI · LICENSED · PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

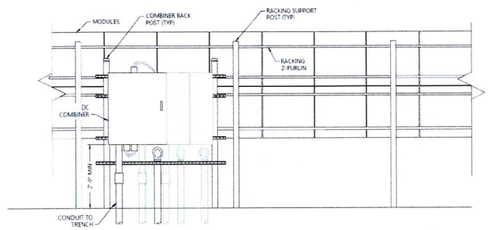
DC STRING WIRE & CONDUIT SCHEDULES

Project

Date
SEPTEMBER 26, 2024

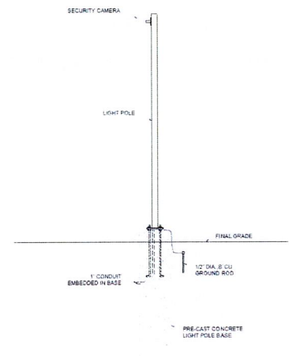
Scale
1/16" = 1'-0"

Sheet
PV-6



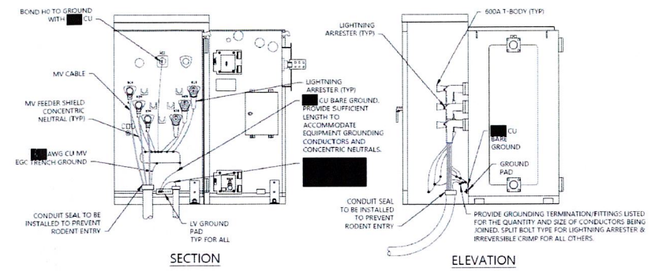
NOTES:
1. DETAIL IS FROM PREVIOUS ECOS ENERGY PROJECT, TO BE USED FOR DESIGN INTENT.

1 PV-7 DC STRING COMBINER BOX MOUNTING DETAIL
NOT TO SCALE



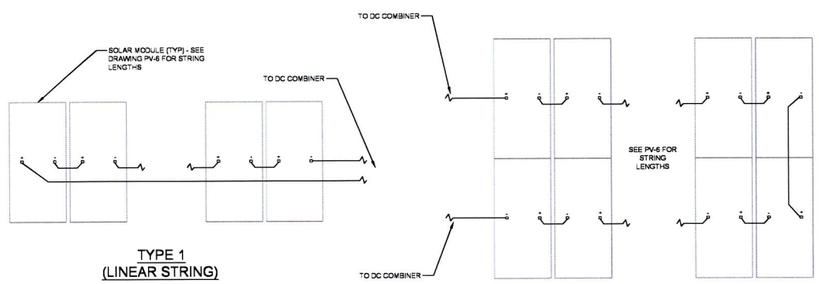
GENERAL NOTES:
1. REFER TO ARRAY PLAN FOR CAMERA LOCATIONS.
2. REFER TO NORDAL DRAWINGS FOR ADDITIONAL INFO ON CAMERA TYPE AND MOUNTING.
3. COORDINATE WITH OWNER ON HEIGHT OF LIGHT POLE TO BE USED

8 PV-7 CAMERA POLE DETAIL
NOT TO SCALE

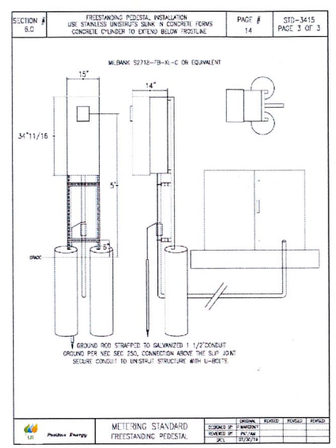


NOTES:
1. DETAIL IS FROM PREVIOUS ECOS ENERGY PROJECT, TO BE USED FOR DESIGN INTENT.

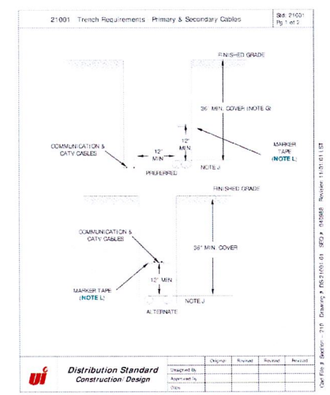
3 PV-7 CUSTOMER OWNED TRANSFORMER SUPPLY & GROUNDING DETAIL
NOT TO SCALE

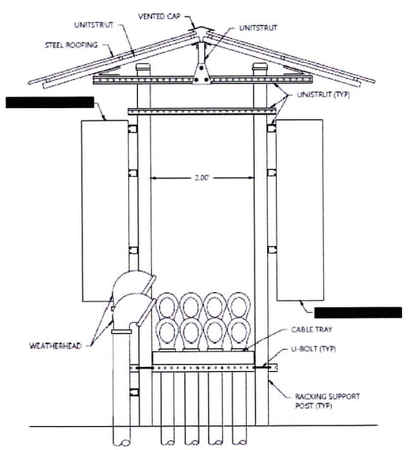


4 PV-7 TYPICAL STRING WIRING DETAILS
NOT TO SCALE



5 PV-7 PRIMARY METER PEDESTAL DETAIL
NOT TO SCALE

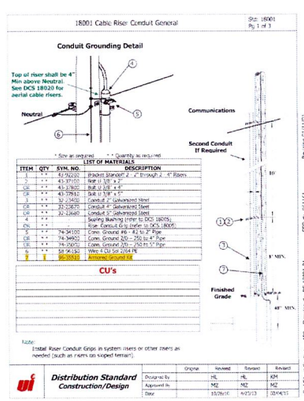


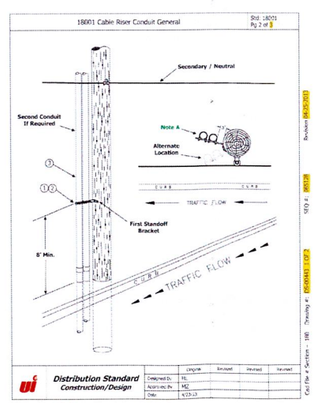


NOTES:
1. DETAIL IS FROM PREVIOUS ECOS ENERGY PROJECT, TO BE USED FOR DESIGN INTENT.

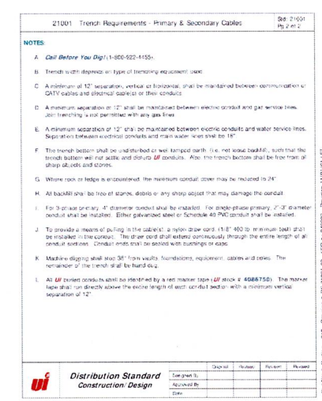
6 PV-7 INVERTER RACK / HUT DETAIL (DIAGRAMMATIC)
NOT TO SCALE

NOTE - INSTALL CONDUIT RISER ON FIELD SIDE OF POLE, OPPOSITE OF VEHICLE TRAFFIC. ONCE INSTALLED, SCHEDULE AN INSPECTION WITH THE UI DISTRIBUTION ENGINEER PRIOR TO BACKFILLING





2 PV-7 SUPPLY FROM OVERHEAD UTILITY POLE SYSTEM
NOT TO SCALE



7 PV-7 UTILITY COMPANY TRENCH DETAIL
NOT TO SCALE

Project Info

PREPARED BY:

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TYPICAL SYSTEM INFO
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REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT SCOTT GEORGENES 32983 LICENSED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

DETAILS

Project

Date
SEPTEMBER 26, 2024

Scale
NTS

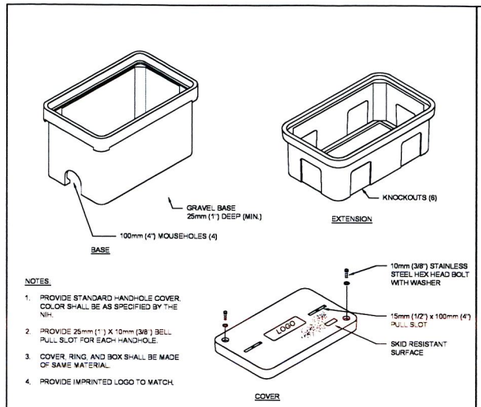
Sheet
PV-7

GENERAL NOTES

1. DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL INTENT FOR THE PV SYSTEM. ITEMS SUCH AS CONDUIT FITTINGS, HANGERS, COVER PLATES, AND JUNCTION BOXES ARE NOT SHOWN BUT ARE REQUIRED SHALL BE PROVIDED BY THE CONTRACTOR AS REQUIRED TO PROVIDE A FULLY FUNCTIONAL SYSTEM IN ACCORDANCE WITH THE NEC.
2. DEFINITIONS SHALL BE REFERENCED FROM THE CURRENT EDITION OF THE NATIONAL ELECTRIC CODE.
3. CONTRACTOR SHALL VISIT THE SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION TO ENSURE COORDINATION OF THE WORK, INCLUDING AVOIDANCE OF OBSTRUCTIONS AND PRESENCE OF ADEQUATE SERVICE CLEARANCE. NO DESTRUCTIVE WORK MAY BE PERFORMED PRIOR TO LOCATING INTERFERENCES.
4. ELECTRICAL ROUTING SHOWN ON PLANS IS CONCEPTUAL AND IS BASED ON THE ENGINEERS BEST JUDGEMENT. CONTRACTOR SHALL PLAN & COORDINATE ACTUAL ROUTING IN FIELD PRIOR TO INSTALLATION. DRAWINGS ARE NOT TO BE SCALED. NOTIFY ENGINEER OF ANY DISCREPANCIES.
5. SERVICE ENTRANCE RATED EQUIPMENT, CT CABINETS AND METER SOCKETS ARE TO BE APPROVED FOR USE BY THE LOCAL UTILITY COMPANY. SEE COVER SHEET FOR UTILITY COMPANY INFORMATION.
6. ALL ELECTRICAL EQUIPMENT PROVIDED MUST BE LABELED, UL LISTED, AND INSTALLED ACCORDINGLY. INSTALL ALL EQUIPMENT AND COMPONENTS IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS.
7. CONTRACTOR SHALL PAY FOR AND COORDINATE ALL REQUIRED PERMITS AND INSPECTIONS.
8. CONTRACTOR SHALL UTILIZE ONLY QUALIFIED WORKMEN LICENSED IN THE STATE WHERE WORK IS BEING PERFORMED AND SHALL FOLLOW ALL OSHA, NFPA 70E AND OWNER STANDARDS.
9. MAINTAIN FIRE RATINGS OF ALL PARTITIONS PENETRATED AS A RESULT OF THIS PROJECT, USING SEALANT OR OTHER ACCEPTABLE METHOD.
10. COMMUNICATION AND POWER CABLES AND CONDUCTORS SHALL NOT SHARE THE SAME RACEWAY.
11. JUNCTION BOXES SHALL BE NEMA 3R AND SIZED PER THE NEC.
12. PROVIDE ALL NEC REQUIRED SIGNAGE. REFER TO DRAWING PV-10 FOR LABEL AND SIGNAGE INFORMATION.
13. LABEL ALL EXPOSED RACEWAYS, CABLE TRAYS, COVERS/ENCLOSURES OF PULL OR JUNCTION BOXES AND CONDUIT BODIES CARRYING PV SYSTEM FEEDERS (AC AND DC). LABELS SHALL APPEAR ON EVERY SECTION OF THE WIRING SYSTEM THAT IS SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS OR FLOORS. NOT MORE THAN 10 APART.
14. CIRCUIT BREAKERS PROVIDED AS A PART OF THIS PROJECT SHALL BE RATED FOR REVERSE FEED WHERE SUBJECT TO REVERSE CURRENTS.
15. PROVIDE APPROPRIATE CONNECTORS FOR WIRE MATERIAL USED.
16. REFER TO RISER DIAGRAM ON PV-1 FOR ELECTRICAL EQUIPMENT & FEEDER SIZE, RATING, AND QUANTITY.
17. STRING WIRING SHALL BE COPPER (RATED 2KV) RHW-2 OR USE-2-UL SUBJECT 4703 RATED FOR 90°C.
18. FOR EXTERIOR CONDUIT, USE RGS IN EXTERIOR APPLICATIONS WHERE EXPOSED OR SUBJECT TO PHYSICAL DAMAGE. USE SCHEDULE 40 PVC FOR UNDERGROUND LOCATIONS. SCHEDULE 80 PVC SHALL BE PROVIDED IN EXTERIOR EXPOSED LOCATIONS WHEN RAIN-TIGHT CONNECTORS AND FITTINGS ARE USED. AND THE CONDUIT IS NOT EXPOSED TO ANY POTENTIAL PHYSICAL DAMAGE. ALL SUPPORTS, BOLTS, STRAPS, AND SCREWS SHALL BE CORROSION RESISTANT.
19. COLOR CODE WIRING FOR EACH VOLTAGE SYSTEM PER INDUSTRY STANDARD COLORING. DC WIRING SHALL BE COLOR CODED RED (+), BLACK (-) AND GREEN (GND).
20. AC AND DC CONDUCTORS SHALL HAVE ENOUGH SLACK TO ACCOMMODATE EXPANSION AND CONTRACTION.
21. PROVIDE EXPANSION FITTINGS WHERE CONDUITS EMERGE FROM UNDERGROUND TO ABOVE GROUND AND CONNECT TO RIGID EQUIPMENT OR SURFACES.

ABBREVIATIONS

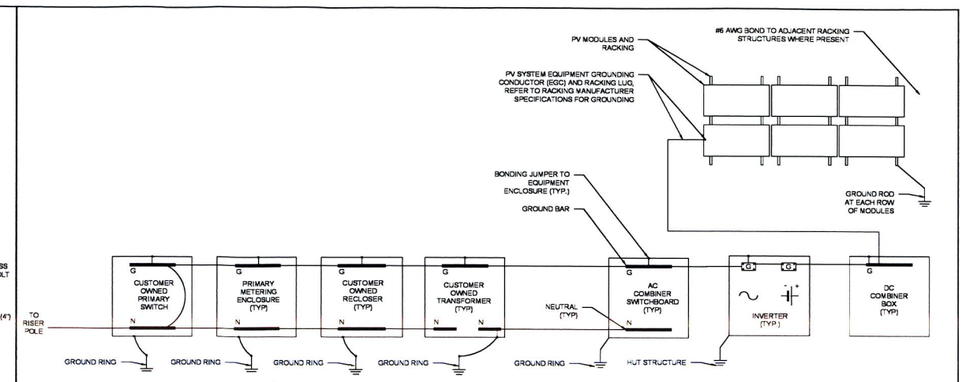
A	AMPERES	MULTI	MULTI-CONDUCTOR CABLE
AC	ALTERNATING CURRENT (60 HZ)	NEC	NATIONAL ELECTRIC CODE
AL	ALUMINUM	NTS	NOT TO SCALE
ATS	AUTOMATIC TRANSFER SWITCH	OF	OWNER FURNISHED
AWG	AMERICAN WIRE GAUGE	P	POLE
C	CONDUIT	PH	PHASE
CB	COMBINER BOX	PNL	PANELBOARD
COMM.	COMMUNICATION	PRI	PRIMARY
CF	CONTRACTOR FURNISHED	PSF	POUNDS PER SQUARE FOOT
CI	CONTRACTOR INSTALLED	PSI	POUNDS PER SQUARE INCH
CT	CURRENT TRANSFORMER	PT	POWER TRANSFORMER
CU	COPPER	PV	PHOTOVOLTAIC
DWG	DRAWING	PVC	POLYVINYL CHLORIDE
EMT	ELECTRICAL METALLIC TUBING	RGS	RIGID GALVANIZED STEEL CONDUIT
EQUIP	EQUIPMENT	SE	SERVICE EQUIPMENT
EX	EXISTING EQUIPMENT TO REMAIN	SEC	SECONDARY
FT	FEET	TX	TRANSFORMER
GFCI/GFI	GROUND-FAULT CIRCUIT-INTERRUPTER	TYP	TYPICAL
GRD	GROUND	UG	UNDERGROUND
IN	INCHES	UL	UNDERWRITER'S LABORATORY
J	JUNCTION	V	VOLTS
KAIC	AMPERE INTERRUPTING CAPACITY	VA	VOLT-AMPERES
KV	KILOVOLT	W	WATTS
KW	KILOWATT	WP	WEATHERPROOF
M	METER	WT	WATERTIGHT
MCB	MAIN CIRCUIT BREAKER	%	PERCENT
MDP	MAIN DISTRIBUTION PANELBOARD	#	NUMBER
MLO	MAIN LUG ONLY	'	FEET
		"	INCHES



NOTES:

1. PROVIDE STANDARD HANDHOLE COVER COLOR SHALL BE AS SPECIFIED BY THE N.R.
2. PROVIDE 25mm (1") X 10mm (3/8") BELL PULL SLOT FOR EACH HANDHOLE.
3. COVER, RING, AND BOX SHALL BE MADE OF SAME MATERIAL.
4. PROVIDE IMPRINTED LOGO TO MATCH.

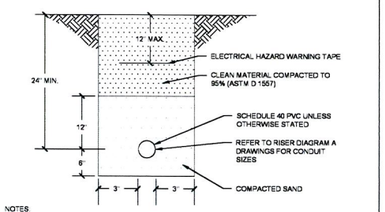
2 PV-8 BASIC PULLBOX / HANDHOLE DETAIL – DC & <600VAC
NOT TO SCALE



NOTES:

1. REFER TO RISER DIAGRAM ON PV-1 FOR NEUTRAL AND GROUND WIRE SIZES.
2. EQUIPMENT GROUND CONNECTIONS SHALL BE MADE AT EVERY SUB-ARRAY.
3. REFER TO EQUIPMENT MANUFACTURER'S SPECIFICATIONS FOR GROUNDING LOCATIONS AND RECOMMENDED CLIPS / LUGS.
4. SEE GROUND RING DETAIL ON DRAWING PV-8.
5. REFER TO EPSC DRAWINGS FOR AC COMBINER SWITCHBOARD GROUNDING REQUIREMENTS.

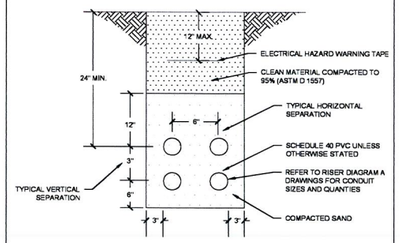
1 PV-8 TYPICAL GROUNDING DETAIL
NOT TO SCALE



NOTES:

1. CONFIRM LOCATION OF ANY EXISTING UNDERGROUND UTILITY PRIOR TO EXCAVATION. DIG BY HAND WHEN IN THE VICINITY OF EXISTING UTILITIES.
2. USE CLEAN FILL FREE OF STONES GREATER THAN 2" IN DIAMETER, FROZEN MATERIAL, SHARPS AND ANY OTHER DEBRIS.
3. WHERE CONDUIT TRAVELS BELOW A PATH SUBJECT TO VEHICULAR TRAFFIC USE CONCRETE ENCASED PVC OR RIGID GALVANIZED STEEL.

3 PV-8 SINGLE ELECTRICAL CONDUIT TRENCH DETAIL (LVDC & LVAC)
NOT TO SCALE



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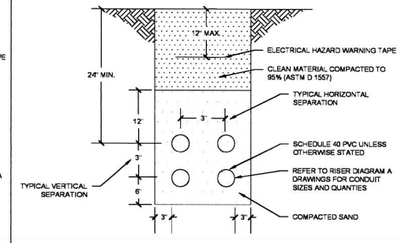
3. WHERE CONDUIT TRAVELS BELOW A PATH SUBJECT TO VEHICULAR TRAFFIC USE CONCRETE ENCASED PVC OR RIGID GALVANIZED STEEL.

4 PV-8 MULTIPLE ELECTRICAL CONDUIT TRENCH DETAIL (AC, 600V & BELOW, STACKED)
NOT TO SCALE



NOTES:

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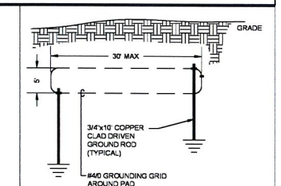
3. WHERE CONDUIT TRAVELS BELOW A PATH SUBJECT TO VEHICULAR TRAFFIC USE CONCRETE ENCASED PVC OR RIGID GALVANIZED STEEL.

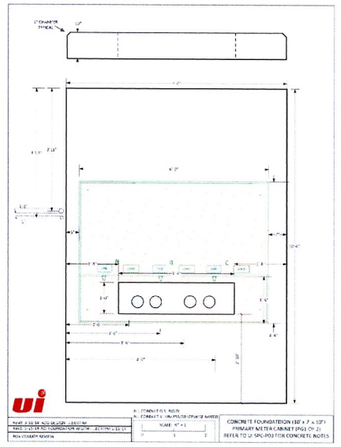
5 PV-8 MULTIPLE ELECTRICAL CONDUIT TRENCH DETAIL (ALL DC FEEDERS)
NOT TO SCALE



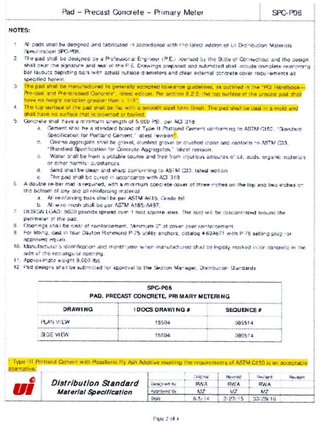
NOTES:

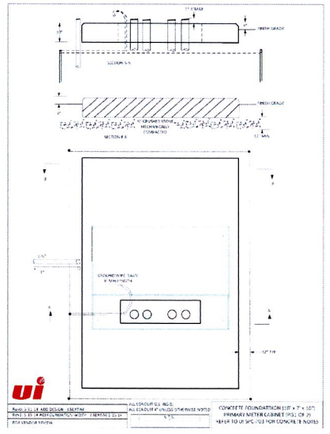
1. RING SHALL EXTEND AROUND EACH EQUIPMENT PAD AND INVERTER HUT.
2. THIS DIAGRAM IS FOR INFORMATIONAL PURPOSES ONLY. EXACT DETAILS OF GROUNDING SYSTEM MAY VARY.
3. ALL ASPECTS OF GROUNDING SYSTEM SHALL COMPLY FULLY WITH ARTICLE 250 OF N.E.C.
4. UTILIZE GROUNDING BUSHINGS AS REQUIRED.
5. PROVIDE ADDITIONAL RODS AS REQUIRED TO ACHIEVE 5 OHMS OR LESS GROUND RESISTANCE.
6. THE FOLLOWING EQUIPMENT SHALL BE CONNECTED TO A GROUND RING:
   - 6.1. PRIMARY METERING ENCLOSURE (DEDICATED RING, #4/0 AWG - SEE DETAIL 7/PV-8)
   - 6.2. PRIMARY RECLOSER (DEDICATED RING, #4/0 AWG)
   - 6.3. TX-1 (EQ PAD RING, #4/0 AWG)
   - 6.4. SWGR-1 (EQ PAD RING, #3/0 AWG)
   - 6.5. EQUIPMENT PAD UNCOATED REBAR (EQ PAD RING, #4/0 AWG, AT OPPOSITE CORNERS)
   - 6.6. AUX POWER PANEL, TRANSFORMER (EQ PAD RING, #6 AWG)
   - 6.7. DAS CABINET, MET CABINET & CAM CABINET (EQ PAD RING, #6 AWG EA)
   - 6.8. MET EQUIPMENT POLE LIGHTNING ROD (EQ PAD RING, #6 AWG)
   - 6.9. TWO INVERTER HUT POSTS (EQ PAD RING, #2 AWG EA)

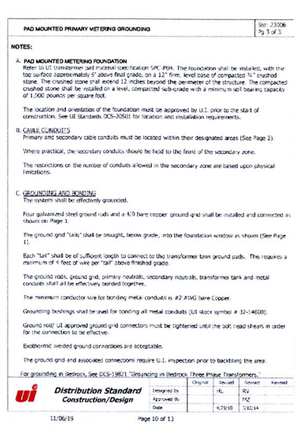
6 PV-8 GROUND RING DETAIL
NOT TO SCALE



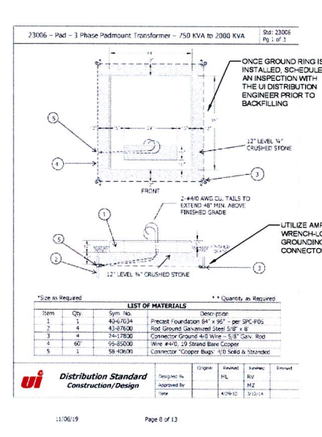
7 PV-8 UTILITY COMPANY PRIMARY METERING ENCLOSURE PAD DETAILS
NOT TO SCALE







THIS PAGE REFERENCES A TRANSFORMER PAD, BUT IT IS TO BE USED FOR GROUNDING AT THE PRIMARY METERING ENCLOSURE PAD



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Project Info

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(FOR EACH OF TWO SYSTEMS):

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STATE OF CONNECTICUT · BRIAN GENDRON · LICENSED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

NOTES, DETAILS & ABBREVIATIONS

Project

Date: SEPTEMBER 26, 2024

Scale: NTS

Sheet: PV-8

KACO new energy

blueplanet 125 TL3

Transformerless, three-phase string inverter.

The trendsetter among inverters.

- Optimized for solar power plants with 1500 volt modules
- Special properties for extreme climatic conditions
- Lean commissioning and maintenance via remote services
- Extensive grid management functions
- Farsighted technical features for future requirements

INVERTER TYPE "F2" IS CURTAILED TO 124KWAC

Technical Data

DC input data	**125 TL3**
Max. recommended PV generator power	147 500 W
MPP range	875 – 1 200 V
Operating range	875 – 1 450 V
Rated DC voltage / start voltage	950 V / 1 000 V
Min. no-load voltage	1 500 V
Max. input current	160 A
Max. short circuit current I_sc	350 A
Number of MPP tracker	1
Connection per tracker	1 – 2
AC output data	
Rated output	125 000 VA
Max. power	137 500 VA
Line voltage	600 V (3P+PE)
Voltage range (3ϕ / PE)	445 – 760 V
Rated frequency (range)	50 Hz / 60 Hz (45 – 65 Hz)
Rated current	3 x 120.3 A
Max. current	3 x 132.3 A
Reactive power / cos ϕ	0 – 100 % Sonr / 0.3 ind. – 0.3 cap
Max. total harmonic distortion (THD)	< 3 %
Number of grid phases	3
General data	
Max. efficiency	99.2 %
Euro-eta efficiency	99.1 %
CEC efficiency	99.0 %
Standby consumption	< 19 W
Cooling concept	Intelligent fan cooling
Mechanical data	
Display	LEDs
Communication	Ethernet (Modbus TCP, Sunspec)
Interfaces	RS485 (Modbus RTU, Sunspec, KACO protocol) USB, optional: 4-DI, 4-DO
Fault signalling relay	potential-free NO/C max. 30 V / 1 A
DC connection	cable lug, max. 240 mm² (1/0 AWG) Cu or Al
AC connection	cable lug, max. 240 mm² (1/0 AWG) Cu or Al
Ambient temperature	-25 °C – +60 °C
Humidity	0 – 100 %
Max. installation elevation (above MSL)	3 000 m
Max. distance from grid	500 m
Cooling	temperature controlled fan
Protection class	IP66 / NEMA 4X
Noise emission	59.2 dB (A)
H x W x D	775 x 870 x 450 mm
Weight	79.2 kg
Certifications	
Safety	UL1741/IEEE 1547, CSA-C22.2 No. 62109-1 CSA-C22.2 No. 62109-2, CSA-C22.2 No. 107.1 IEC 62109-1 ed. 1, EN 50524-1, 1-2-0-1, EN 61000-3-11/-12
Grid connection note	overview tab, homepage / download area

* Power derating at high ambient temperature

Versions	S	XL
Number of DC inputs	1 / 2	1 / 2
DC switch	✓	
DC SPD	Type 1 + 2	Type 1 + 2
AC SPD	○	○
RS485 interface SPD	○	○
Ethernet interface SPD	○	○
PID Set	○	○

standard: ✓ optional: ○

www.kaco-newenergy.com

KACO new energy GmbH | Carl-Zeiss-Str. 1 | 74172 Neckarsulm | Germany

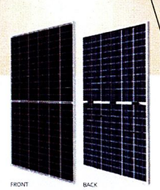
1 PV-9 INVERTER DATA SHEET
NOT TO SCALE

BIFACIAL GAIN VARIES BASED ON GROUND CONDITIONS (E.G. HIGHER GAIN WITH SNOW ON THE GROUND)

NEW

Preliminary Technical Information Sheet

CanadianSolar



TOPBiHiKu7

BIFACIAL TOPCON

650 W ~ 720 W

CS7N-650 | 655 | 660 | 665 | 670 | 675 | 680 | 685 | 690 | 695 | 700 | 705 | 710 | 715 | 720TB-AG (IEC1000 V)

CS7N-650 | 655 | 660 | 665 | 670 | 675 | 680 | 685 | 690 | 695 | 700 | 705 | 710 | 715 | 720TB-AG (IEC1500 V)

MORE POWER

- Module power up to 720 W
- Module efficiency up to 23.2 %
- Up to 85% Power Bifaciality, more power from the back side
- Excellent anti-LeTID & anti-PID performance. Low power degradation, high energy yield
- Lower temperature coefficient (Pmax): -0.30%/°C, increases energy yield in hot climate
- Lower LCOE & system cost

MORE RELIABLE

- Minimizes micro-crack impacts
- Heavy snow load up to 5400 Pa, wind load up to 2400 Pa*

* For detailed information, please refer to the Installation Manual.

- **12 Years** Enhanced Product Warranty on Materials and Workmanship*
- **30 Years** Linear Power Performance Warranty*

1st year power degradation no more than 1%
Subsequent annual power degradation no more than 0.4%

*According to the applicable Canadian Solar Limited Warranty Statement.

MANAGEMENT SYSTEM CERTIFICATES*

ISO 9001:2015 / Quality management system
ISO 14001:2015 / Standards for environmental management system
ISO 45001:2018 / International standards for occupational health & safety

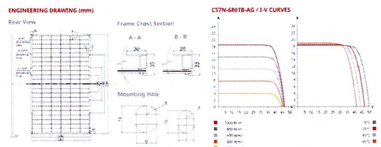
PRODUCT CERTIFICATES*

* The specific certificates applicable to different module types and markets will vary, and therefore not all of the certificates listed herein will simultaneously apply to the products you order or use. Please contact your local Canadian Solar sales representative to confirm the specific certificates available for your Product and applicable in the regions in which the products will be used.

CSI Solar Co., Ltd. is committed to providing high quality solar photovoltaic modules, solar energy and battery storage solutions to customers. The company was recognized as the No. 1 module supplier for quality and performance/price ratio in the IHS Module Customer Insight Survey. Over the past 20 years, it has successfully delivered over 70 GW of premium-quality solar modules across the world.

Canadian Solar MSS (Australia) Pty Ltd.
333 Drummond Street, Carlton VIC 3053, Australia, sales.au@csisolar.com: www.csisolar.com/au

ENGINEERING DRAWING (mm)



CS7N-680TB-AG / I-V CURVES

ELECTRICAL DATA | STC*

	Nominal Max. Power (Pmax)	Opt. Operating Voltage (Vmp)	Opt. Operating Current (Imp)	Open Circuit Voltage (Voc)	Short Circuit Current (Isc)	Module Efficiency
CS7N-665TB-AG	665 W	38.6 V	17.23 A	46.5 V	18.14 A	21.4%
Bifacial Gain** 5%	698 W	38.6 V	18.09 A	46.5 V	19.05 A	22.5%
Bifacial Gain** 10%	732 W	38.6 V	18.97 A	46.5 V	19.95 A	23.6%
Bifacial Gain** 20%	798 W	38.6 V	20.68 A	46.5 V	21.77 A	25.7%
CS7N-670TB-AG	670 W	38.8 V	17.27 A	46.7 V	18.19 A	21.6%
Bifacial Gain** 5%	704 W	38.8 V	18.15 A	46.7 V	19.10 A	22.7%
Bifacial Gain** 10%	737 W	38.8 V	19.00 A	46.7 V	20.01 A	23.7%
Bifacial Gain** 20%	804 W	38.8 V	20.72 A	46.7 V	21.83 A	25.9%
CS7N-675TB-AG	675 W	39.0 V	17.31 A	46.9 V	18.24 A	21.7%
Bifacial Gain** 5%	709 W	39.0 V	18.19 A	46.9 V	19.15 A	22.8%
Bifacial Gain** 10%	743 W	39.0 V	19.04 A	46.9 V	20.06 A	23.9%
Bifacial Gain** 20%	810 W	39.0 V	20.76 A	46.9 V	21.87 A	26.0%
CS7N-680TB-AG	680 W	39.2 V	17.35 A	47.1 V	18.29 A	21.9%
Bifacial Gain** 5%	714 W	39.2 V	18.22 A	47.1 V	19.20 A	23.0%
Bifacial Gain** 10%	748 W	39.2 V	19.09 A	47.1 V	20.12 A	24.1%
Bifacial Gain** 20%	816 W	39.2 V	20.82 A	47.1 V	21.95 A	26.3%
CS7N-685TB-AG	685 W	39.4 V	17.39 A	47.3 V	18.34 A	22.1%
Bifacial Gain** 5%	719 W	39.4 V	18.26 A	47.3 V	19.26 A	23.1%
Bifacial Gain** 10%	754 W	39.4 V	19.14 A	47.3 V	20.17 A	24.2%
Bifacial Gain** 20%	822 W	39.4 V	20.87 A	47.3 V	22.01 A	26.5%
CS7N-690TB-AG	690 W	39.6 V	17.43 A	47.5 V	18.38 A	22.3%
Bifacial Gain** 5%	725 W	39.6 V	18.31 A	47.5 V	19.31 A	23.3%
Bifacial Gain** 10%	759 W	39.6 V	19.17 A	47.5 V	20.23 A	24.4%
Bifacial Gain** 20%	828 W	39.6 V	20.92 A	47.5 V	22.07 A	26.7%

* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature 25°C. Pmax measurement tolerance: ±1%.
** Bifacial Gain: The additional gain from the back side compared to the power of the front side at the standard test condition. It depends on mounting construction, height, tilt angle etc. | and albedo of the ground.

ELECTRICAL DATA | NMOT*

	Nominal Max. Power (Pmax)	Opt. Operating Voltage (Vmp)	Opt. Operating Current (Imp)	Open Circuit Voltage (Voc)	Short Circuit Current (Isc)
CS7N-665TB-AG	502 W	36.4 V	13.78 A	44.0 V	14.63 A
CS7N-670TB-AG	506 W	36.6 V	13.81 A	44.1 V	14.67 A
CS7N-675TB-AG	510 W	36.8 V	13.84 A	44.3 V	14.71 A
CS7N-680TB-AG	513 W	37.0 V	13.86 A	44.5 V	14.75 A
CS7N-685TB-AG	517 W	37.2 V	13.91 A	44.7 V	14.79 A
CS7N-690TB-AG	521 W	37.4 V	13.94 A	44.9 V	14.83 A

* Under Nominal Module Operating Temperature (NMOT), irradiance of 800 W/m², spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

ELECTRICAL DATA

Operating Temperature	-40°C ~ +85°C
Max. System Voltage	1500 V (IEC/UL) or 1000 V (IEC/UL)
Module Fire Performance	TYPE 29 (UL 61730) or CLASS C (IEC61730)
Max. Series Fuse Rating	35 A
Application Classification	Class A
Power Tolerance	0 ~ + 5 W
Power Bifaciality*	80 %

* Power Bifaciality = Pmax_rear / Pmax_front, both Pmax_rear and Pmax_front are measured under STC. Bifaciality Tolerance: ± 5%.

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.30 % / °C
Temperature Coefficient (Voc)	-0.26 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature	41 ± 2°C

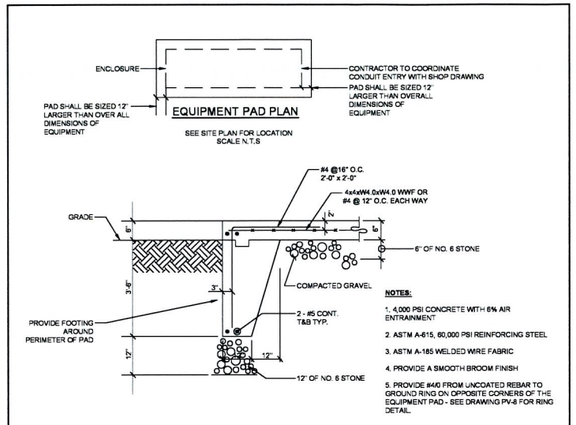
PARTNER SECTION

* The specifications and key features contained in this data sheet may deviate slightly from our actual products due to the ongoing innovation and product enhancement. CSI Solar Co., Ltd. reserves the right to make necessary adjustment to the information described herein at any time without further notice.
Please be kindly advised that the products should be handled and installed by qualified people who have professional skills and please carefully read the safety and installation instructions before using our PV modules.

Canadian Solar MSS (Australia) Pty Ltd.
333 Drummond Street, Carlton VIC 3053, Australia, sales.au@csisolar.com: www.csisolar.com/au

* Manufactured and assembled in China, Thailand and Vietnam.

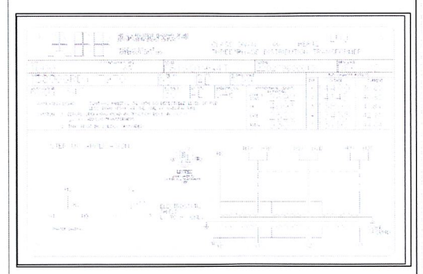
2 PV-9 MODULE DATA SHEET
NOT TO SCALE



NOTES:

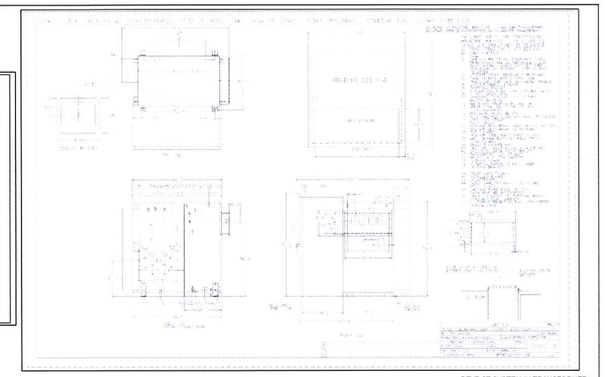
1. 4,000 PSI CONCRETE WITH 6% AIR ENTRAINMENT
2. ASTM A-615, 60,000 PSI REINFORCING STEEL
3. ASTM A-185 WELDED WIRE FABRIC
4. PROVIDE A SMOOTH BROOM FINISH
5. PROVIDE #4/0 FROM UNCOATED REBAR TO GROUND RING ON OPPOSITE CORNERS OF THE EQUIPMENT PAD - SEE DRAWING PV-8 FOR RING DETAIL.

3 PV-9 EQUIPMENT PAD DETAIL (TYPICAL)
NOT TO SCALE



BENZ ST SYSTEM #1 TRANSFORMER

BENZ ST SYSTEM #2 TRANSFORMER



BENZ ST SYSTEM #1 TRANSFORMER

BENZ ST SYSTEM #2 TRANSFORMER

JCLENERGY

3 PHASE PADMOUNTED TRANSFORMER CLASS KNAN

65°C RISE 60 HERTZ MFG DATE SER

kVA 1000

HV 13200Y/7620

LV 600Y/346

BIL HV 95 BIL LV 30 MAT HV Al MAT LV Al

IMPEDANCE @ 85°C RATED VOLTS %

STEP-UP OPERATION

GALLONS OF NATURAL ESTER 345

MASS	kg.	pounds
CORE & COIL	1232	2715
UNTANKING (HEAVIEST PIECE)		
TANK	1253	2761
LIQUID NATURAL ESTER	1179	2598
TOTAL WT	3664	8074

TAP CHANGER

TAP POS	VOLTAGE	85°C AMPS
1/A	14145	49.8
2/B	13804	41.8
3/C	13520	42.7
4/D	13198	43.7
5/E	12860	44.9
6/F	12470	46.3
7/G	12156	47.5

UTILIZE TAP POSITION 2 (13.80kV TO BEST MATCH 13.8kV SYSTEM VOLTAGE)

H.V. H2 H1 H3 X1 X3 L.V. X2 X0 X1 X3

PHASOR DIAGRAM

H1A H1B H2A H2B H3A H3B

Y-BLACK DELTA-RED

CLF CLF CLF

EXP EXP EXP

REMOVABLE GROUND STRAP

H0 X0 H1 X1 H3 X3

CONNECTION DIAGRAM

LISTED

MAXIMUM OPERATING PRESSURES OF LIQUID PRESERVATION SYSTEM: 10PSI (70kPa) POSITIVE AND 2PSI (7kPa) NEGATIVE. TANK DESIGNED FOR HIGHER 15 INCHES OF WATER COLUMN (3.7kPa).

LIQUID LEVEL BELOW TOP SURFACE OF THE HIGHEST POINT ON THE HIGHEST HANDHOLE FLANGE AT 25 °C IS 143 mm (5.63in)

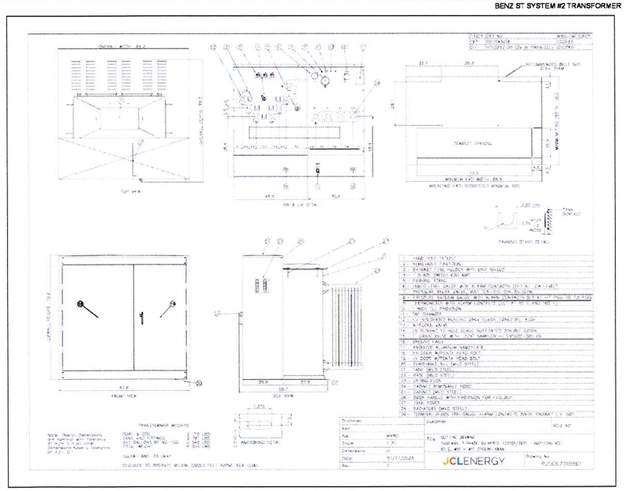
LIQUID VOLUME AT 100 °C IS 1000 mm (39.4in) BELOW TOP OF TANK

PRESSURE RELIEVING DEVICE ABOUT AT RATED POLES AT 1000 kPa (145 PSI)

CAUTION BEFORE OPERATING READ INSTRUCTIONS IEC-76(10)

CONTAINS NO DETECTABLE LEAD OR PCB (LESS THAN 1 PPM) AT THE TIME OF MANUFACTURE

IMPEDANCE MEETS ANSI STANDARDS WITH TOLERANCE OF +/-7.5% ACTUAL TESTED IMPEDANCE WILL BE STAMPED ON NAME PLATE



4 PV-9 CUSTOMER OWNED TRANSFORMER DATA SHEETS
NOT TO SCALE

Project Info

PREPARED BY:

SG ENGINEERING LLC

56 FOXCROFT COURT
SOUTHINGTON, CT
SGEDESIGN.COM
sge@sgedesign.com

PREPARED FOR:

ecos ENERGY

222 S 9TH STREET, SUITE 1600
MINNEAPOLIS, MN 55402
ECOSRENEWABLE.COM

TYPICAL SYSTEM INFO (FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT · BRIAN GENDRON · LICENSED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

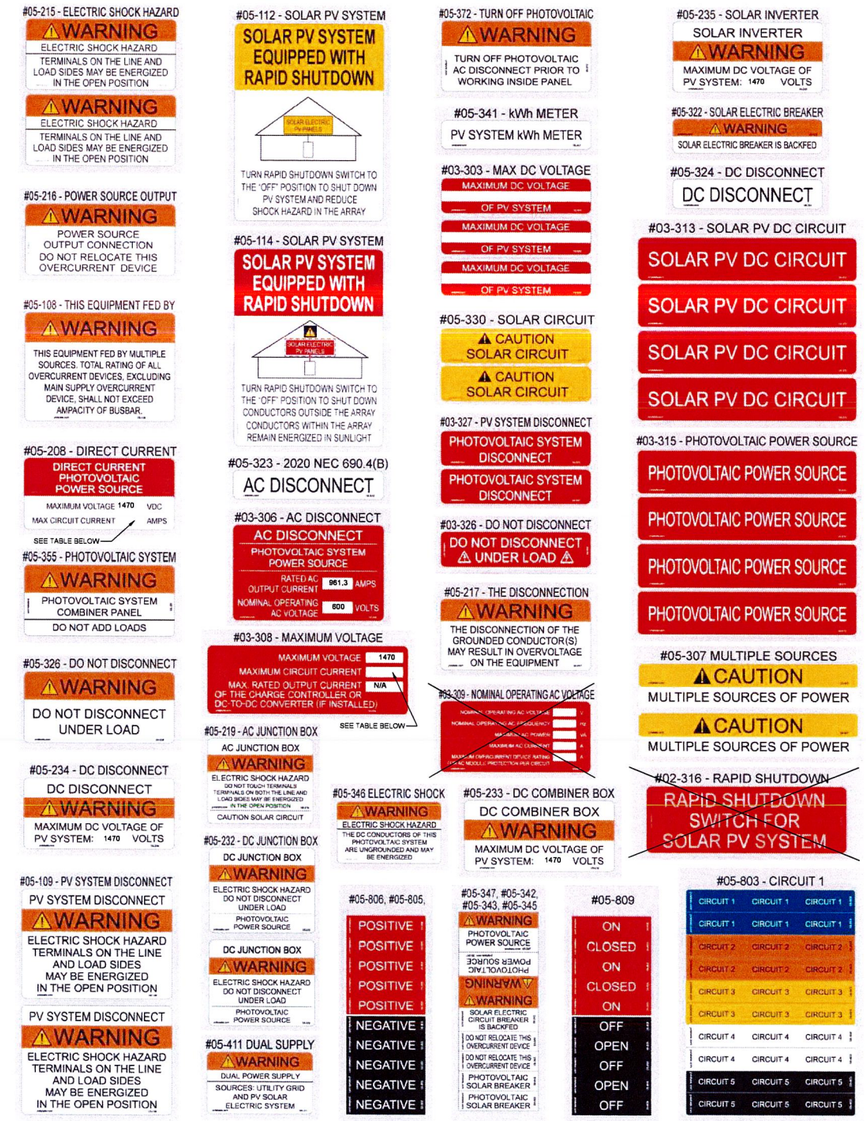
EQUIPMENT DATA SHEETS & DETAILS

Project

Date
SEPTEMBER 26, 2024

Scale
NTS

Sheet
PV-9

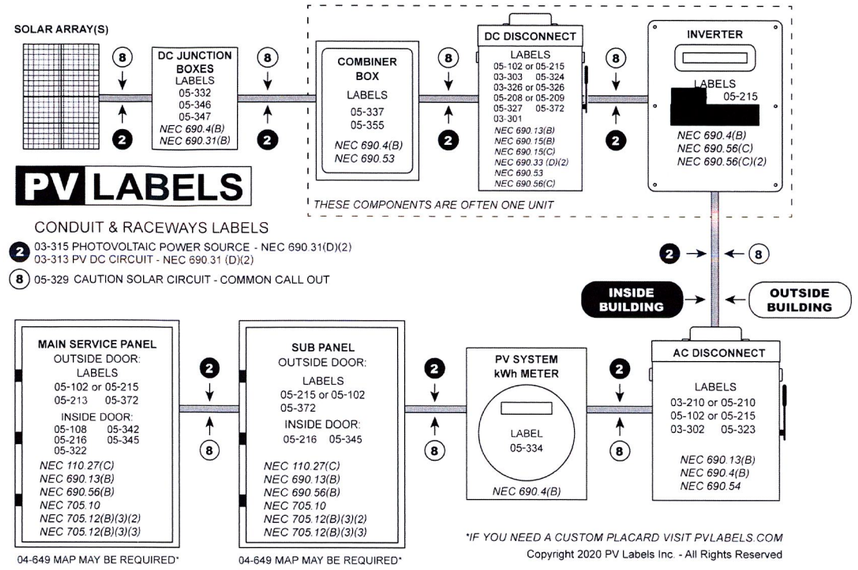


SOURCE: http://www.pvlabels.com

1 PV-10 LABELS

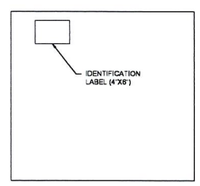
PHOTOVOLTAIC SOLAR SYSTEM MARKING - DC STRINGS

RECOMMENDATIONS BASED ON 2020 NEC, COMMON CALL OUTS AND PACKAGE CONTENTS



SOURCE: http://www.pvlabels.com/

2 PV-10 LABEL LOCATIONS



STRING NUMBER LABEL

Project Info

PREPARED BY:

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PREPARED FOR:

ecos ENERGY

222 S 9TH STREET, SUITE 1600
MINNEAPOLIS, MN 55402
ECOSRENEWABLE.COM

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REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT SIGNER GENDRON LICENSED PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

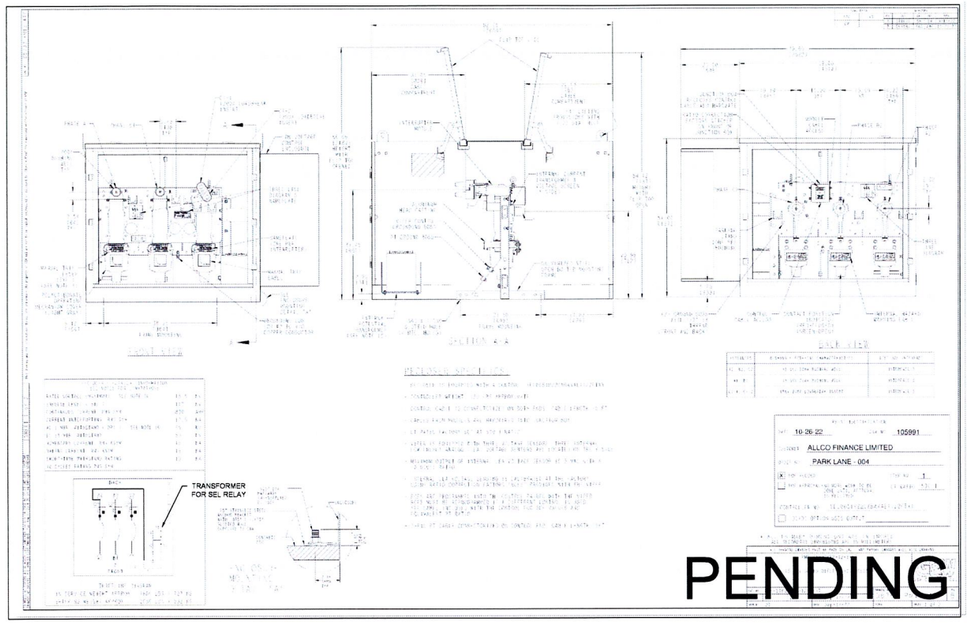
LABELS & SIGNAGE

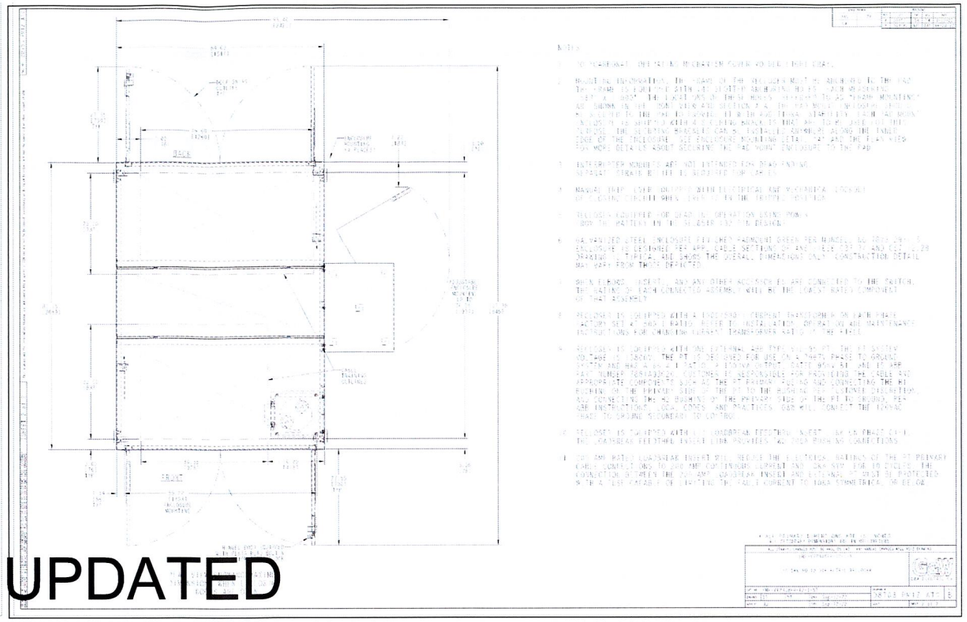
Project

Date SEPTEMBER 26, 2024

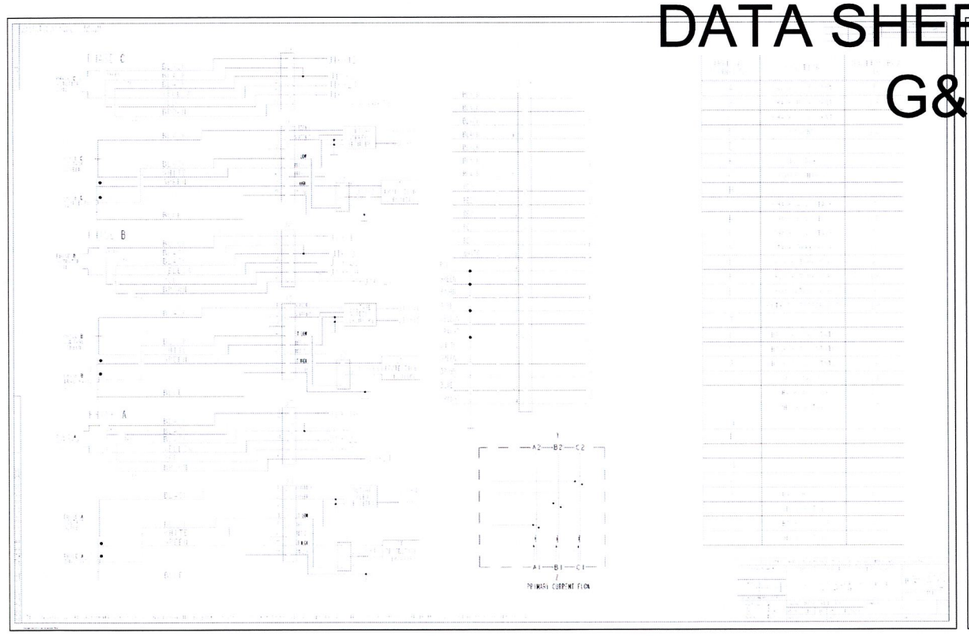
Scale NTS

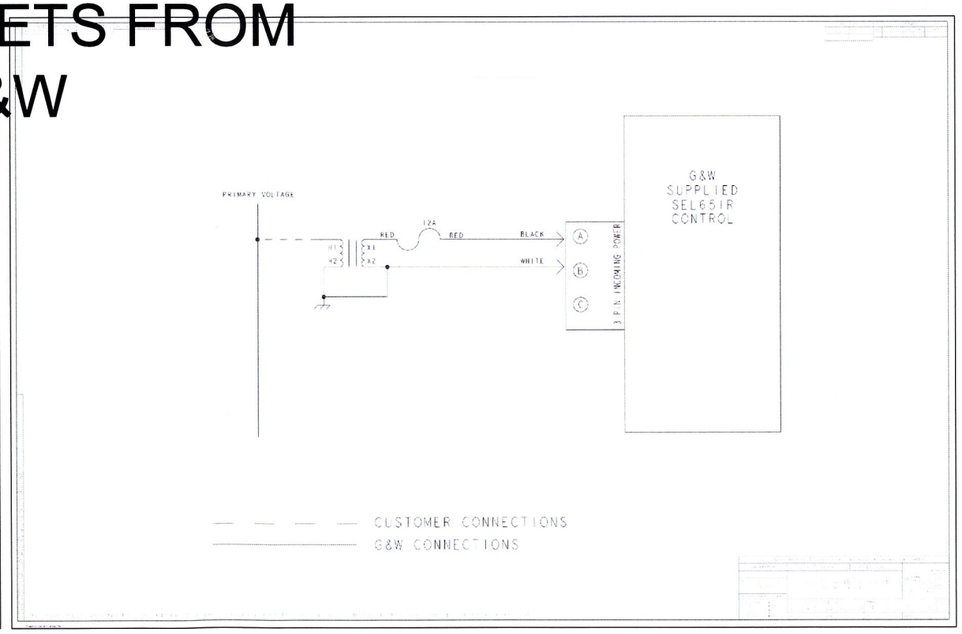
Sheet PV-10





PENDING UPDATED
DATA SHEETS FROM
G&W





1 PV-11 CUSTOMER OWNED RECLOSER DATA SHEETS
NOT TO SCALE

Project Info

PREPARED BY:

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PREPARED FOR:

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MINNEAPOLIS, MN 55402
ECOSRENEWABLE.COM

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(FOR EACH OF TWO SYSTEMS):

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REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT
STEPHEN GENDRON
LICENSED
PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

CUSTOMER OWNED RECLOSER
DATA SHEETS

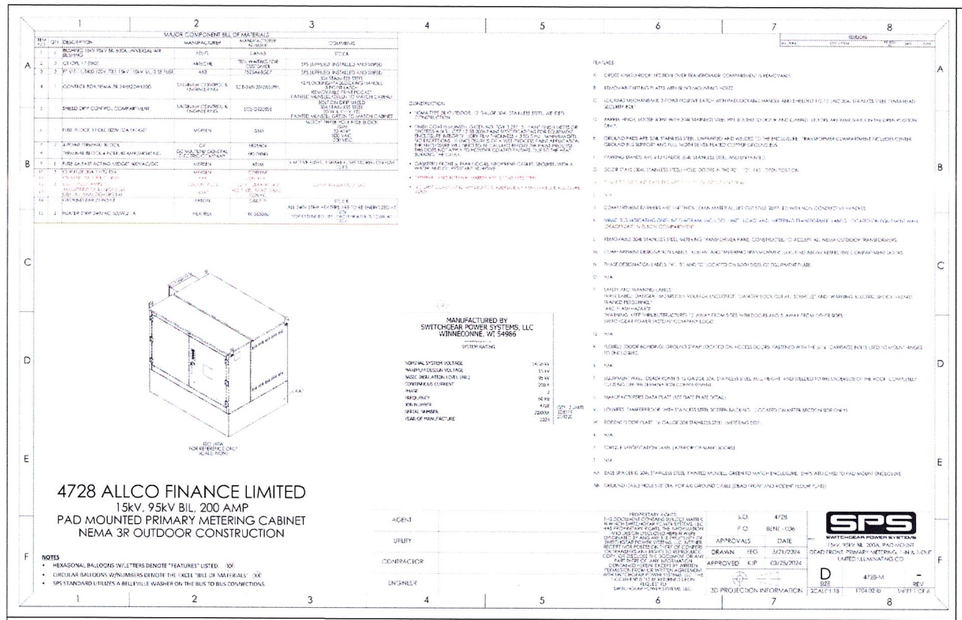
Project

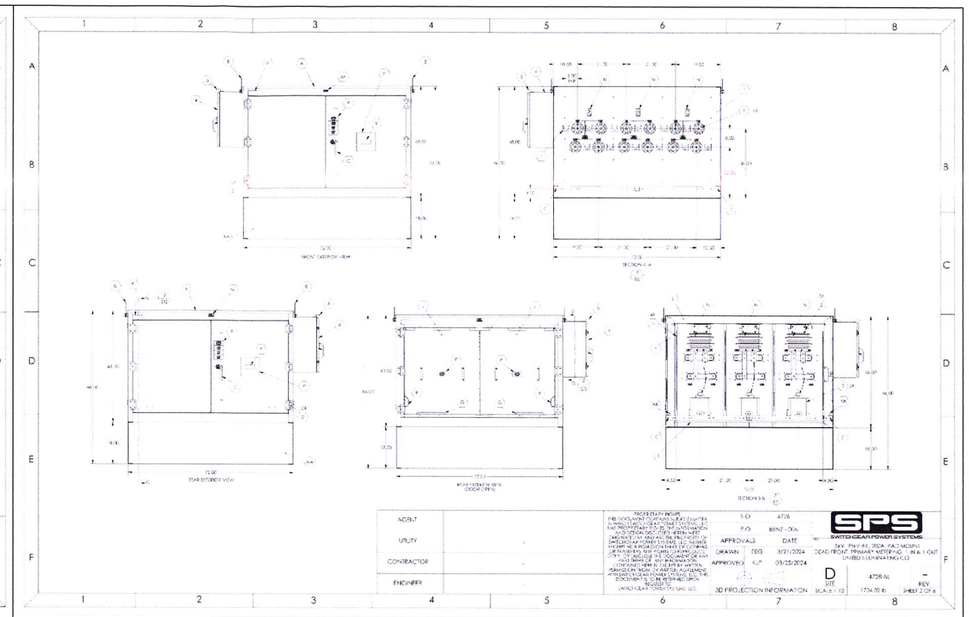
Date
SEPTEMBER 26, 2024

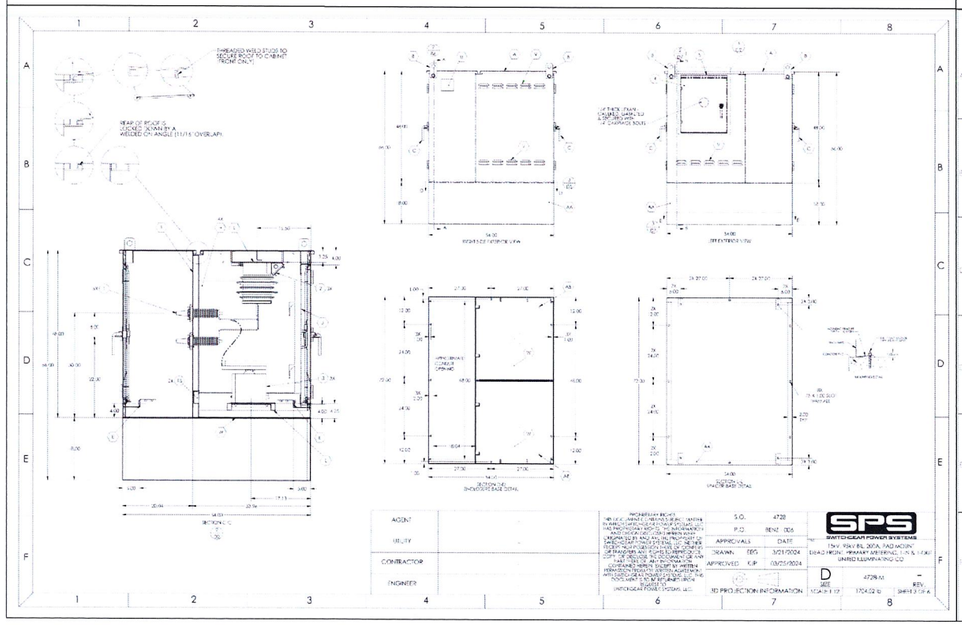
Scale
NTS

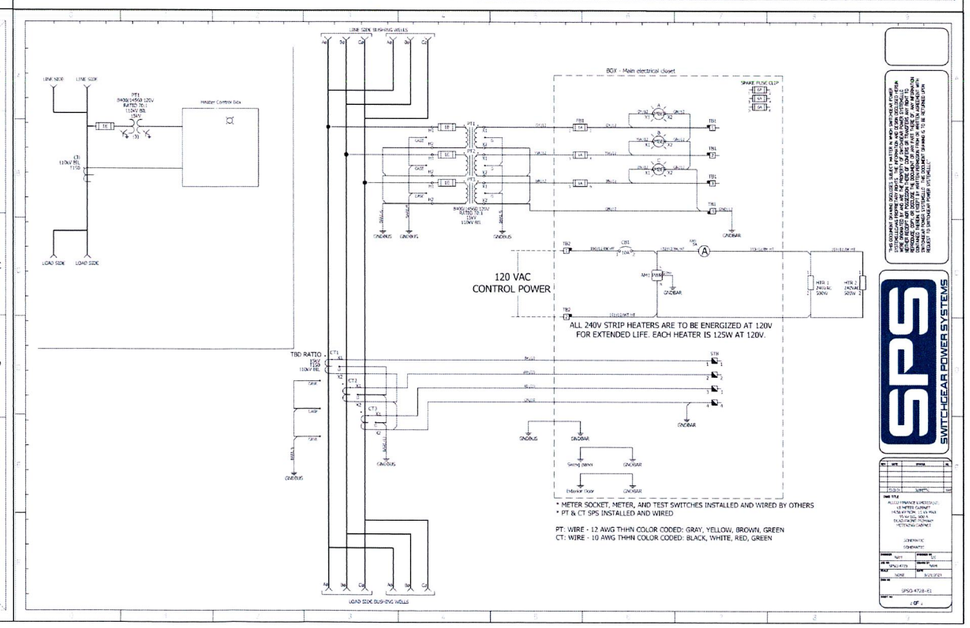
Sheet
PV-11

PENDING APPROVAL FROM U.I.









SEE SUBMITTAL FOR ADDITIONAL INFORMATION

1 PV-12 PRIMARY METERING CABINET DATA SHEETS
NOT TO SCALE

Project Info

PREPARED BY:

SG ENGINEERING LLC

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PREPARED FOR:

ecos ENERGY

222 S 9TH STREET, SUITE 1600
MINNEAPOLIS, MN 55402
ECOSRENEWABLE.COM

TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):

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- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT
STEVEN GERDHAM
LICENSED
PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

PRIMARY METERING ENCLOSURE
DATA SHEETS

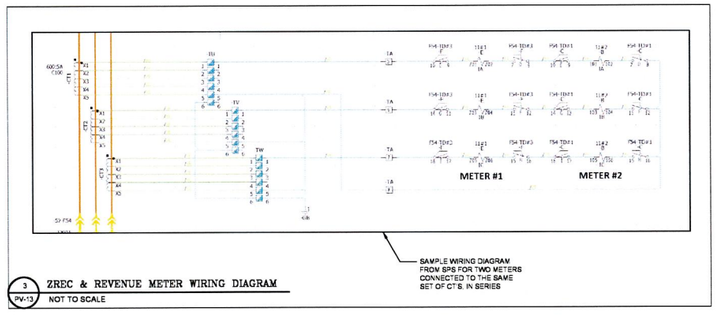
Project	Sheet
Date: SEPTEMBER 26, 2024	PV-12
Scale: NTS	

PENDING UPDATED DATA SHEETS FROM TERRASMART

1 PV-13 DC COMBINER BOX DATA SHEET
NOT TO SCALE

PENDING UPDATED DATA SHEETS FROM TERRASMART

2 PV-13 DC DISCONNECT SWITCH DATA SHEET
NOT TO SCALE



3 PV-13 ZREC & REVENUE METER WIRING DIAGRAM
NOT TO SCALE

Project Info

PREPARED BY:

SG ENGINEERING LLC

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PREPARED FOR:

ecos ENERGY

222 S 9TH STREET, SUITE 1600
MINNEAPOLIS, MN 55402
ECOSRENEWABLE.COM

TYPICAL SYSTEM INFO
(FOR EACH OF TWO SYSTEMS):

- 1,348.620 KW DC STC + BIFACIAL GAIN
- 999.000 KW / KVA AC
- (7) KACO 125TL3 INVERTERS
- (1) KACO 125TL3 INVERTER CURTAILED TO 124 KW AC
- (988) CANADIAN SOLAR CS7N-680TB-AG BIFACIAL MODULES (680W STC)
- (988) CANADIAN SOLAR CS7N-685TB-AG BIFACIAL MODULES (685W STC)

REC#ZL22227 (SYSTEM #1)
REC#ZL22229 (SYSTEM #2)

U.I. METERS #TBD (NEW METERS)

U.I. ACCT #TBD (NEW ACCOUNT)

STATE OF CONNECTICUT
STEPHEN GENDRON
LICENSED
PROFESSIONAL ENGINEER

No.	Revision/Issue	Date

BENZ SOLAR
GROUND MOUNTED PV SYSTEM

31 BENZ STREET
ANSONIA, CT 06041

EQUIPMENT DATA SHEETS

Project

Date
SEPTEMBER 26, 2024

Scale
NTS

Sheet
PV-13