

**PROJECT**  
 PROPOSED PHOTOVOLTAIC ARRAY  
 615.78 kW DC/249.0 kW AC  
 225 BODWELL STREET  
 AVON, MA 02322

**OWNER**  
 MARSHALL PAPER TUBE COMPANY  
 225 BODWELL STREET  
 AVON, MA 02322

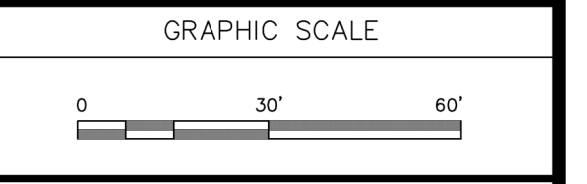
**REVISIONS**

NO.	DATE	DESCRIPTION

**ZONING DATA:**

DISTRICT: INDUSTRIAL OVERLAY DISTRICT: WATER RESOURCE PROTECTION		
CRITERIA	REQUIRED	PROPOSED
MINIMUM LOT AREA	40,000 S.F.	173,790 S.F.
MINIMUM FRONTAGE	200 FT.	265.0 FT.
MINIMUM FRONT YARD	40 FT.	39.8 FT.
MINIMUM SIDE YARD	25 FT.	23 FT.
MINIMUM REAR YARD	40 FT.	104.2 FT.
MAXIMUM HEIGHT	40 FT.	<40 FT.
MAXIMUM BLDG. LOT COVERAGE	60%	43.9%

CADD FILE	
DESIGNED BY	NAC
DRAWN BY	
CHECKED BY	NAC
DATE	3-24-23
DRAWING SCALE	1"=30'-0"



SHEET TITLE

**PROPOSED LAYOUT PLAN**

**RECORD OWNER:**  
 ASSESSORS MAP: B7 BLOCK: 3 LOT: 3  
 225 BODWELL STREET  
 MARSHALL PAPER TUBE COMPANY  
 DEED REFERENCE BOOK: 27526 PAGE: 101  
 PLAN REFERENCE PLAN BK: 4767 PAGE: 258

- NOTES:**
- PROPERTY LINE, STREET LINE AND OWNER INFORMATION WAS PROVIDED BY ZENITH CONSULTING ENGINEERS, LLC.
  - THE SUBJECT SITE IS LOCATED WITHIN THE "INDUSTRIAL" ZONING DISTRICT AS DEPICTED ON THE TOWN OF AVON ZONING DISTRICT MAP DATED AUGUST 16, 2021.
  - PROPOSED BATTERY STORAGE SYSTEM IS SITED PER NFPA 855: STANDARD FOR THE INSTALLATION OF STATIONARY ENERGY STORAGE SYSTEMS, SECTION 9.5.2.6.1.5.

**FLOOD NOTE:**  
 THIS PROPERTY IS LOCATED IN ZONE "X" OF THE FLOOD INSURANCE RATE MAP, AS SHOWN ON MAP No. 25021C0218E, WHICH BEARS AN EFFECTIVE DATE OF JULY 17, 2012, AND IS NOT LOCATED WITHIN A SPECIAL FLOOD HAZARD AREA.

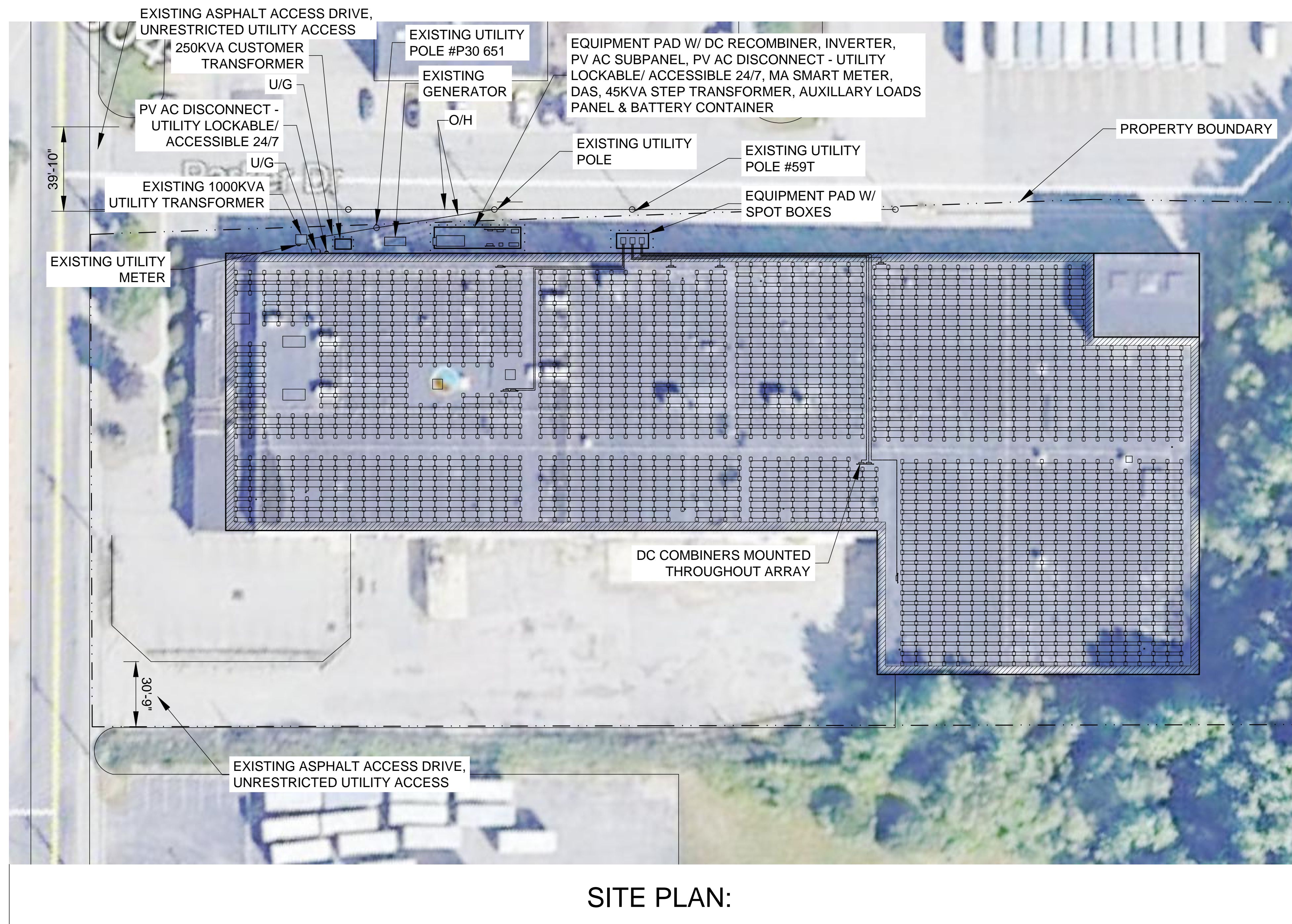
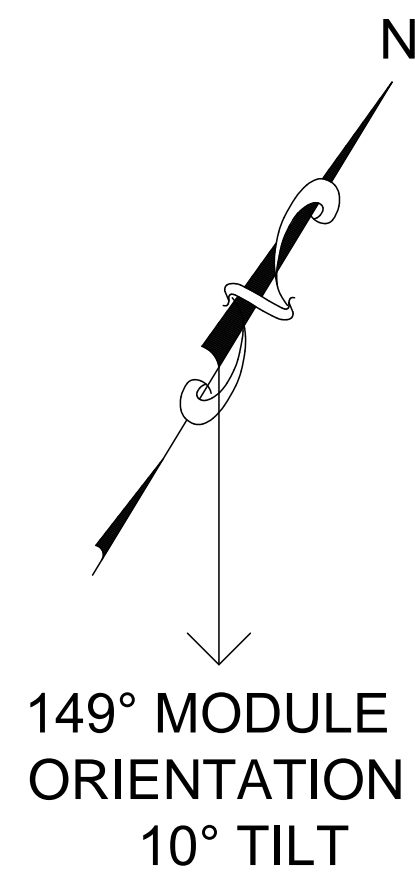
- ENVIRONMENTAL NOTES:**
- SITE IS NOT WITHIN AN A.C.E.C. (AREA OF CRITICAL ENVIRONMENTAL CONCERN).
  - SITE IS NOT WITHIN AN AREA OF ESTIMATED HABITAT OF RARE WILDLIFE PER NHESP MAP AUGUST 2021 "ESTIMATED HABITATS OF RARE WILDLIFE" FOR USE WITH THE MA WETLANDS PROTECTION ACT REGULATIONS (310 CMR 10)."
  - SITE DOES NOT CONTAIN A CERTIFIED VERNAL POOL PER NHESP MAP AUGUST 1, 2021 "CERTIFIED VERNAL POOLS."
  - SITE IS NOT LOCATED WITHIN A STATE APPROVED ZONE II GROUND WATER RECHARGE PROTECTION AREA.
  - SITE IS LOCATED WITHIN AN OUTSTANDING RESOURCE WATER AREA (ORW).



**NATHAN A. COLLINS**  
 PROFESSIONAL ENGINEER, MA REGISTRATION #48140

DRAWING NO.  
**C-1**  
 PROJECT: 225B00WELL





SHEET #	TITLE:	DWG. #
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PROJECT DATA	
INTEGRATOR:	NEXTGRID P.O. BOX 7775 #73069 SAN FRANCISCO, CA 94120
SITE:	225 BODWELL STREET AVON, MA 02322
CODES:	NEC-2020 IBC-2015 9TH EDITION CMR 780

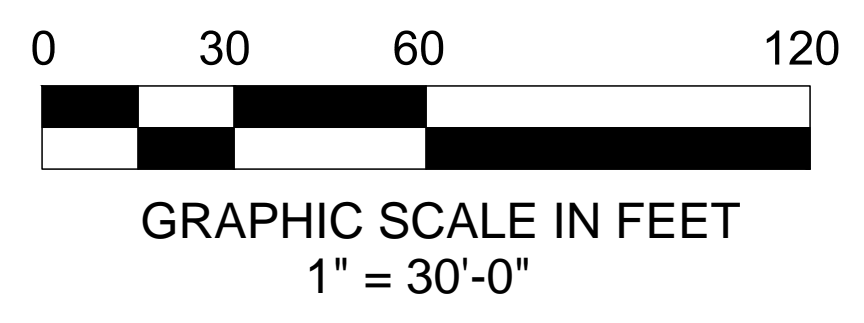
SOLAR ARRAY:	
MODULE:	ASTRONERGY CHSM72M(DG)/F-BH 405W 648 MODULES PHONO SOLAR PS385M-24/TH 385W 918 MODULES
RACKING:	BALLASTED @ 10 DEGREES
INVERTER:	(1) EPC PD250/AC-480
DC STORAGE:	(9) ALENCON SPOT 1000 CONVERTERS
DC OUTPUT:	615,870 W DC - STC
AC OUTPUT:	249,000 W AC

LOADS:	
GROUND SNOW	30 PSF
WIND LOAD	138 MPH
PV ARRAY	10 PSF MAX

ASHRAE TEMPERATURE:			
SOUTH WEYMOUTH NAS			
ELEV.	HIGH TEMPERATURE		LOW TEMPERATURE
	0.4%	2% AVG.	EXTREME MINIMUM
49m	35°C	32°C	-19°C

ARRAY SIZE				
ROOFTOP	615.87-kW DC	249.0-kW AC	1,566 MODULES	623.9 MWH /YR

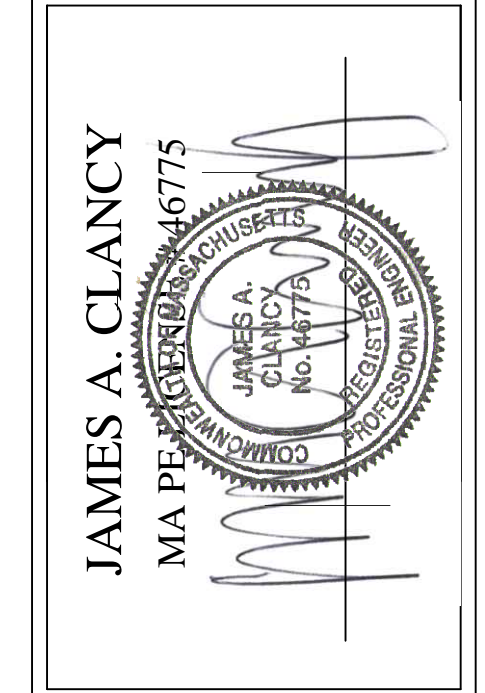
**225 BODWELL ST.**  
**615,870 - KW DC**  
**249.00 KW AC**  
**PHOTOVOLTAIC POWER SYSTEM**  
**W / 1,000 kWh DC-COUPLED STORAGE**



**ARC DESIGN**  
 409 NORTH MAIN STREET  
 ELMER, NJ 08318  
 (856) 712-2166 FAX: (856) 358-1511

PREPARED FOR:  
**NextGrid**  
 PO BOX 7775 #73069  
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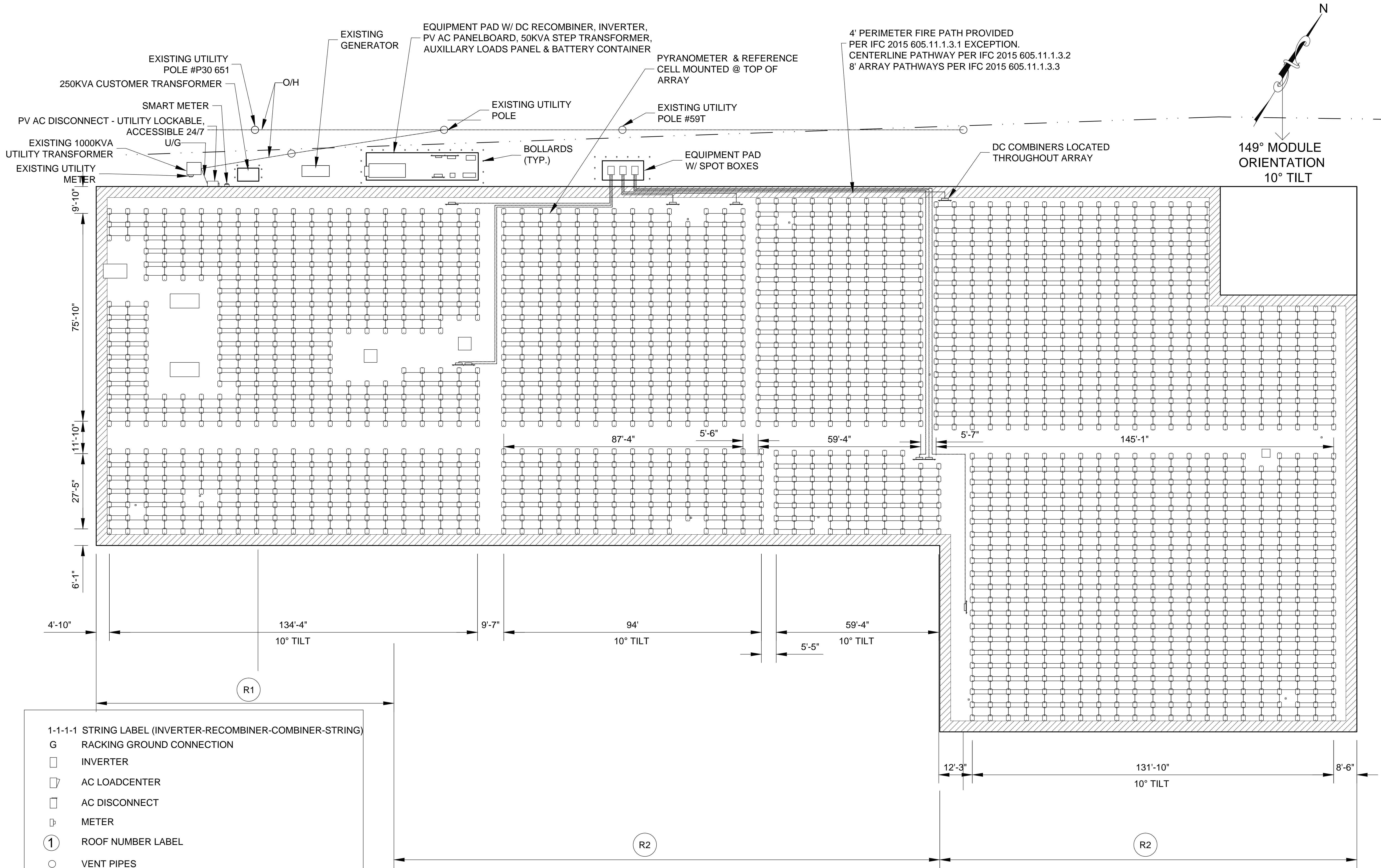
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07-31-20	LAYOUT CHANGE
11-16-21	MOD/DC CONFIG CHANGE

JOB #  
 DRWN RCA  
 CHKD JAC  
 SCALE AS NOTED  
 DATE 05-19-2021

COVER SHEET

A-1





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JAMES A. CLANCY  
 MA PE REG. NO. 6775

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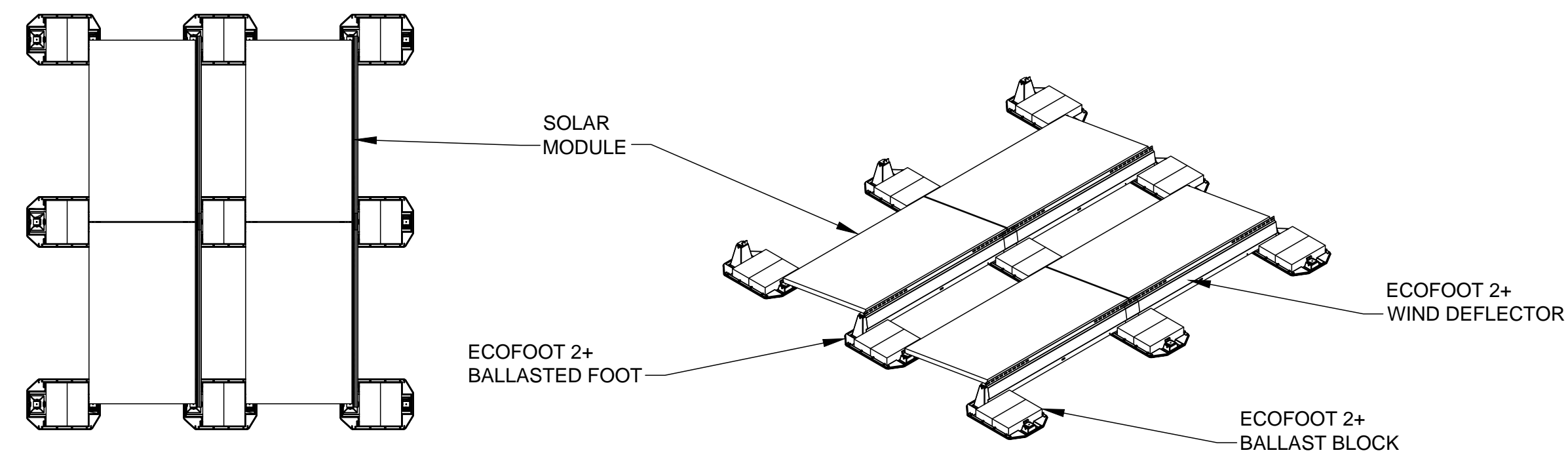
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- 1-1-1-1 STRING LABEL (INVERTER-RECOMBINER-COMBINER-STRING)
- G RACKING GROUND CONNECTION
- INVERTER
- ▭ AC LOADCENTER
- AC DISCONNECT
- ⊕ METER
- ① ROOF NUMBER LABEL
- VENT PIPES
- VENTS
- ⊗ ROOF DRAINS
- ⊗ MECHANICAL EQUIPMENT
- H HATCH

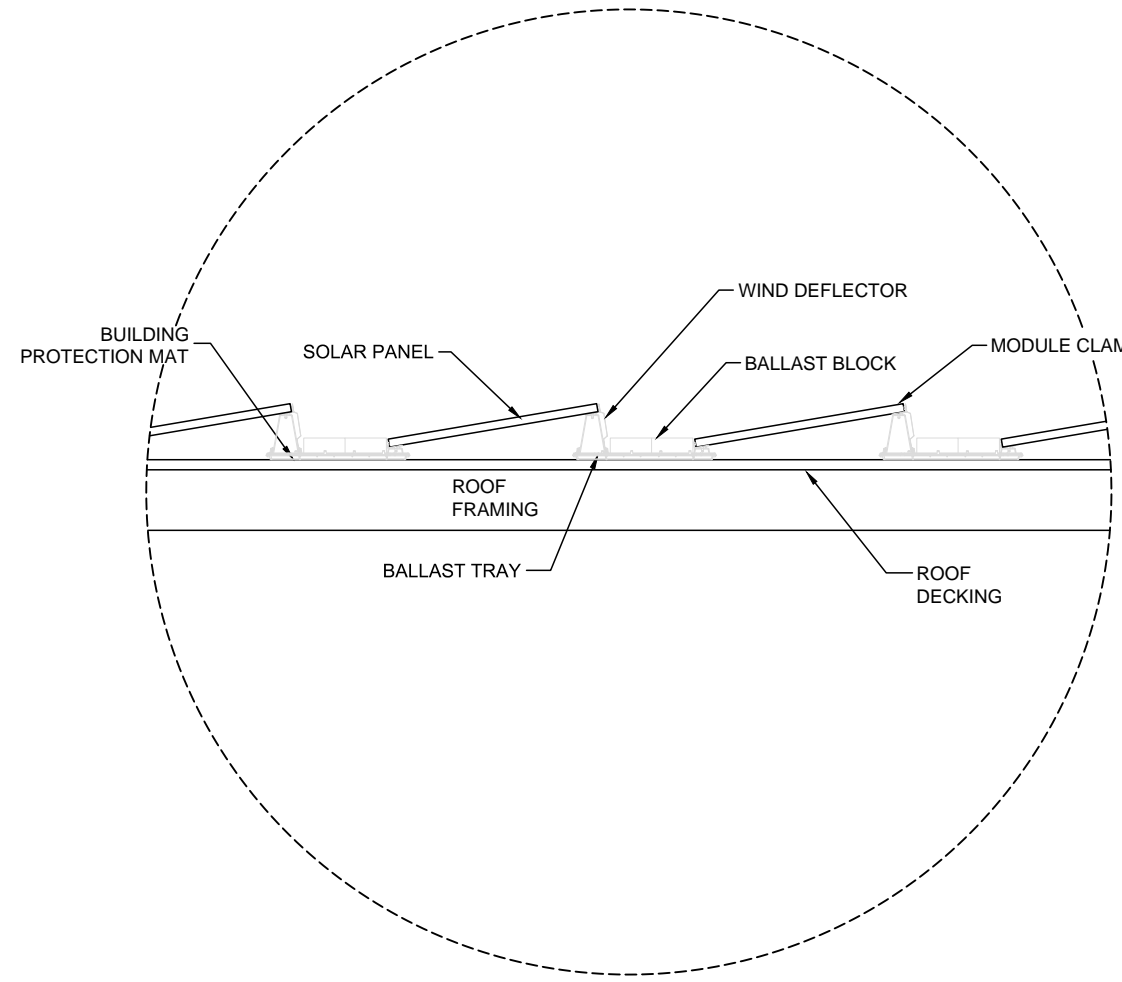
1 MODULE LAYOUT  
 SCALE: 1/16" = 1'-0"

THE EXISTING ROOF STRUCTURE HAS BEEN EVALUATED FOR THE PROPOSED NEW SOLAR LOAD AND DETERMINED TO BE OF SUFFICIENT CAPACITY TO INSTALL THE PROPOSED SOLAR ARRAY AS FOLLOWS:  
 A) MEMBRANE ROOF- BALLASTED RACK SYSTEM NOT TO EXCEED A WEIGHT OF 10.0 LBS/SQ.FT. ROOF R1 NOT TO EXCEED A WEIGHT OF 6.0 LBS/SQ. FT.

MODULE LAYOUT PLAN



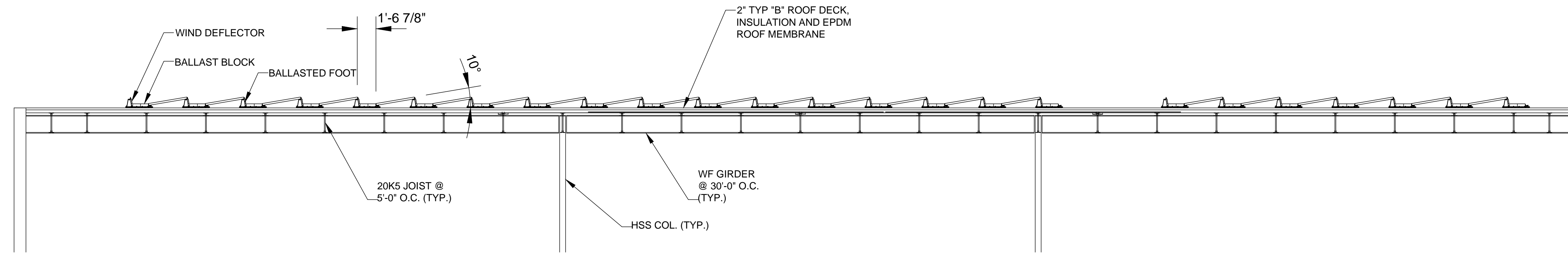
1 ECOLIBRIUM ECOFOOT 2+ DETAIL(TOP)  
SCALE: N.T.S.



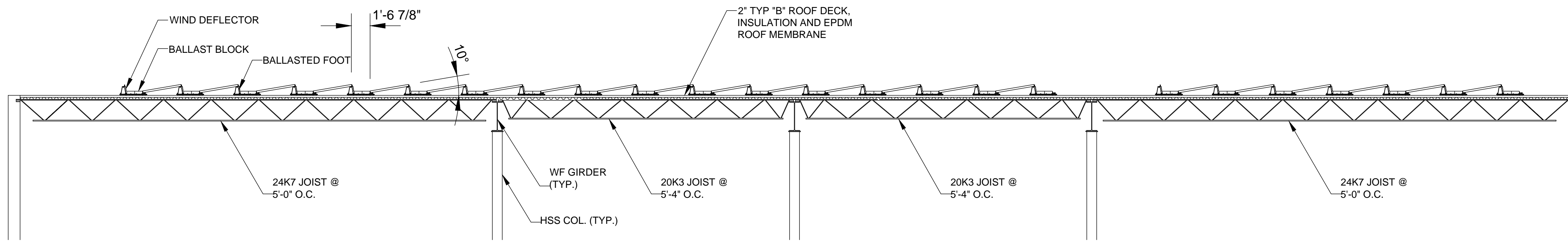
3 ROOF DETAIL  
SCALE: N.T.S.

REFER TO BALLAST PLANS AND  
ENGINEERING REPORTS FOR  
EXACT SIZE AND LOCATION OF BALLASTING.

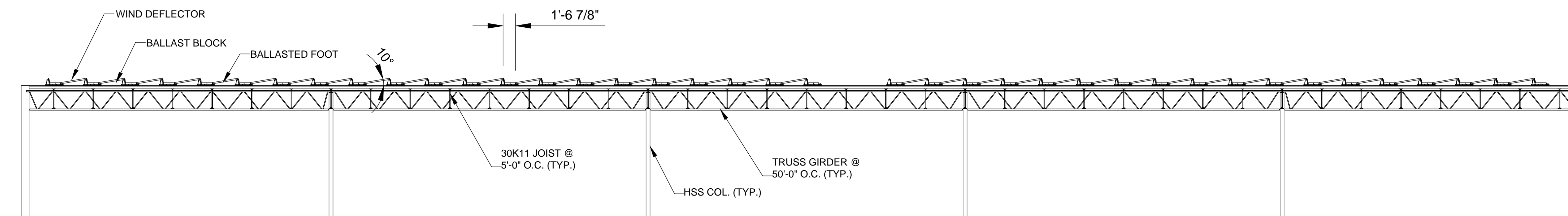
2 ECOLIBRIUM ECOFOOT 2+ DETAIL(SIDE)  
SCALE: N.T.S.



4 ROOF SECTION R1  
SCALE: 3/16"=1'-0"



5 ROOF SECTION R2  
SCALE: 3/16"=1'-0"



6 ROOF SECTION R2  
SCALE: 1/8"=1'-0"

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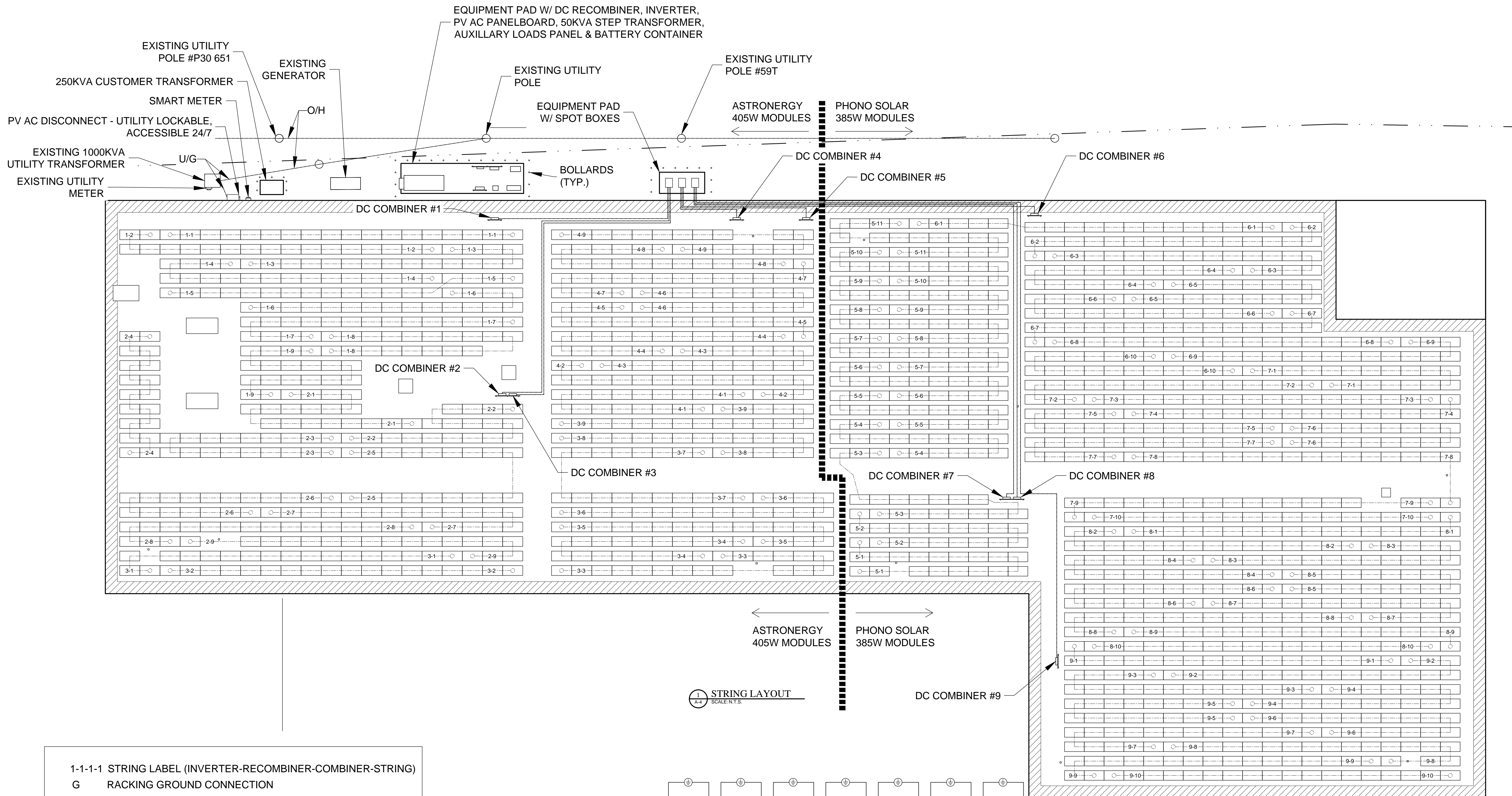
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JAMES A. CLANCY  
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Professional Engineer Seal

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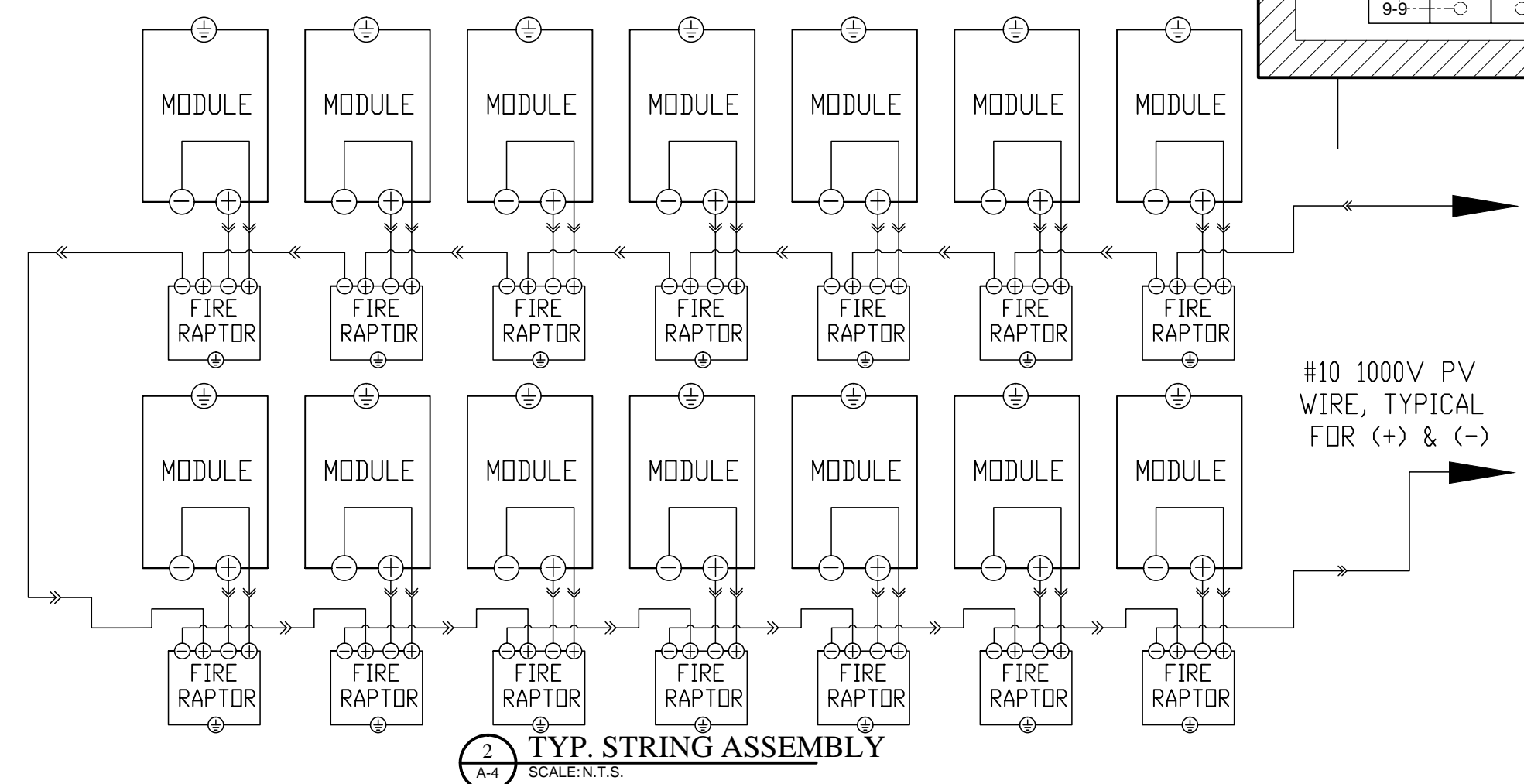
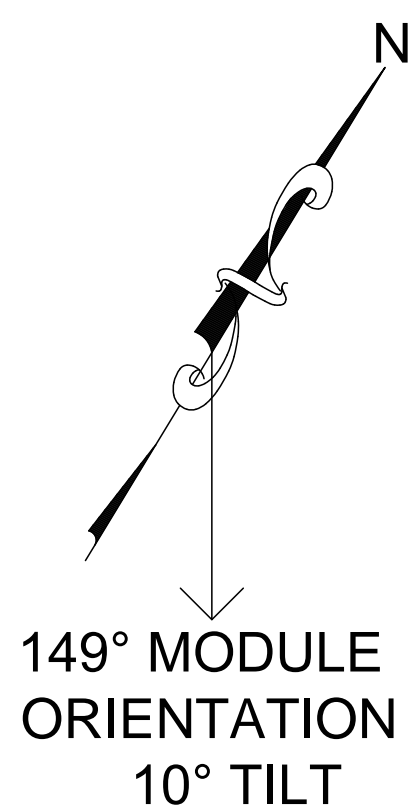
JOB #	
DRWN	RCA
CHKD	JAC
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1 STRING LAYOUT  
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- G RACKING GROUND CONNECTION
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- ⊞ MECHANICAL EQUIPMENT
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2 TYP. STRING ASSEMBLY  
SCALE: N.T.S.

STRING MAP

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**A-4**

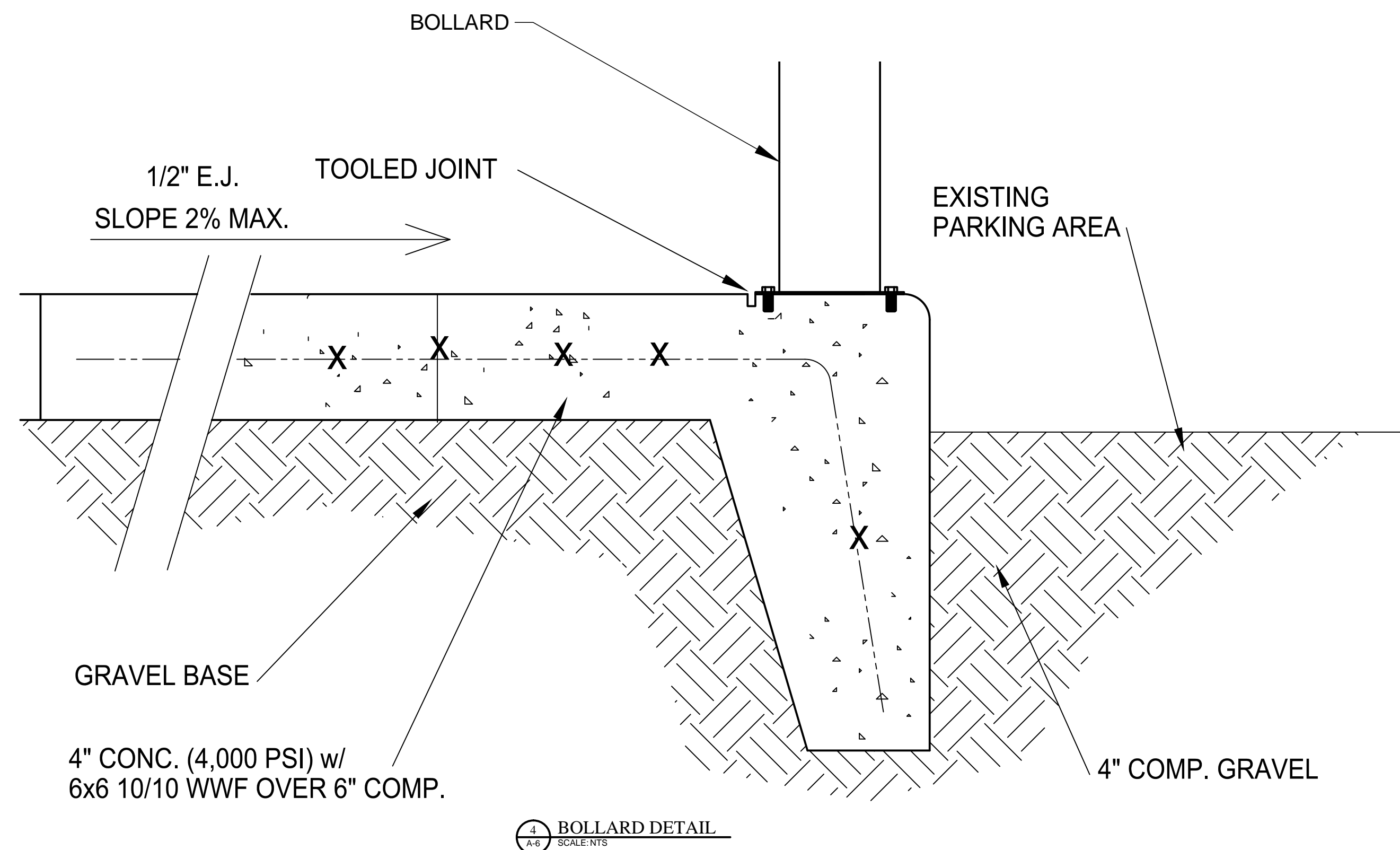
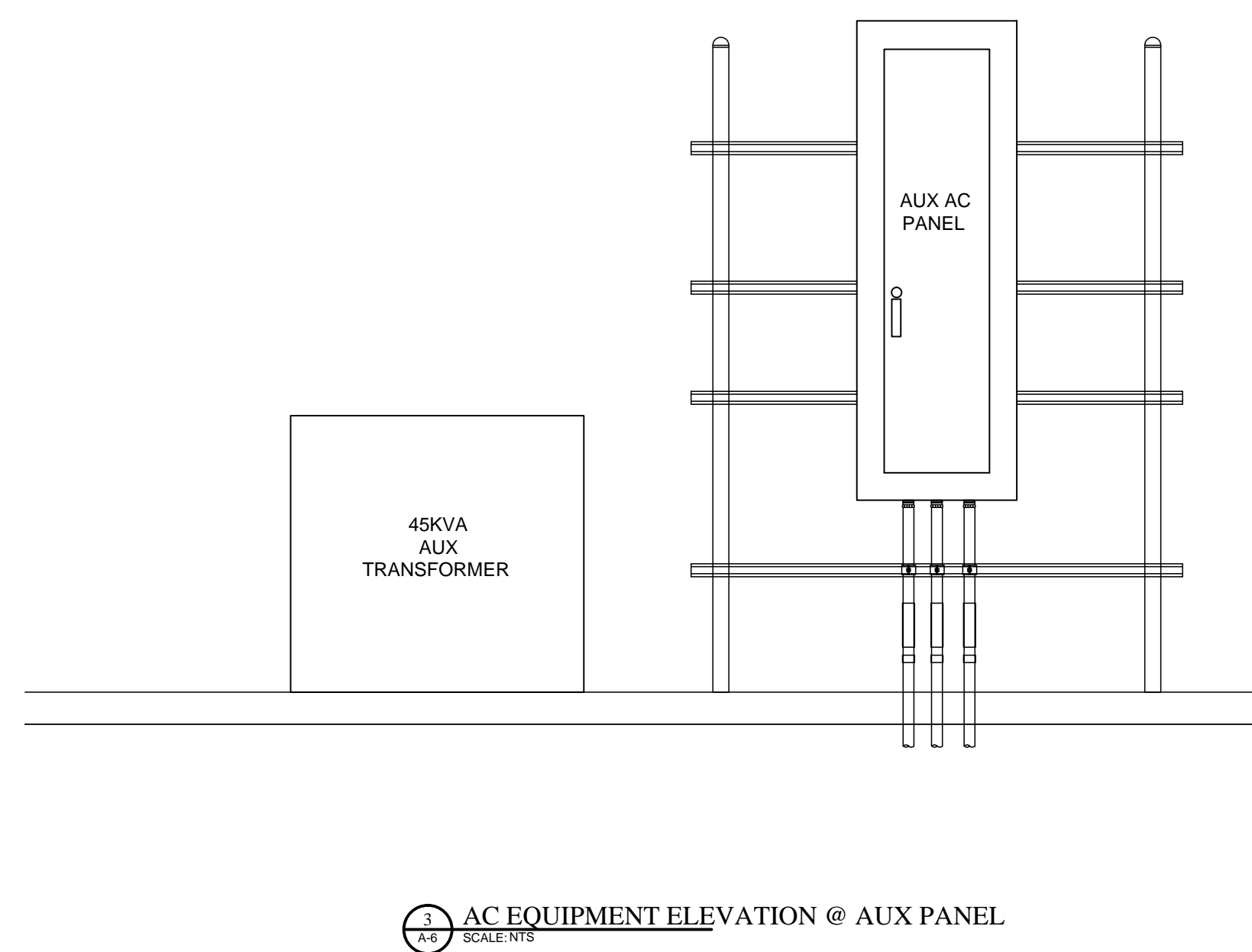
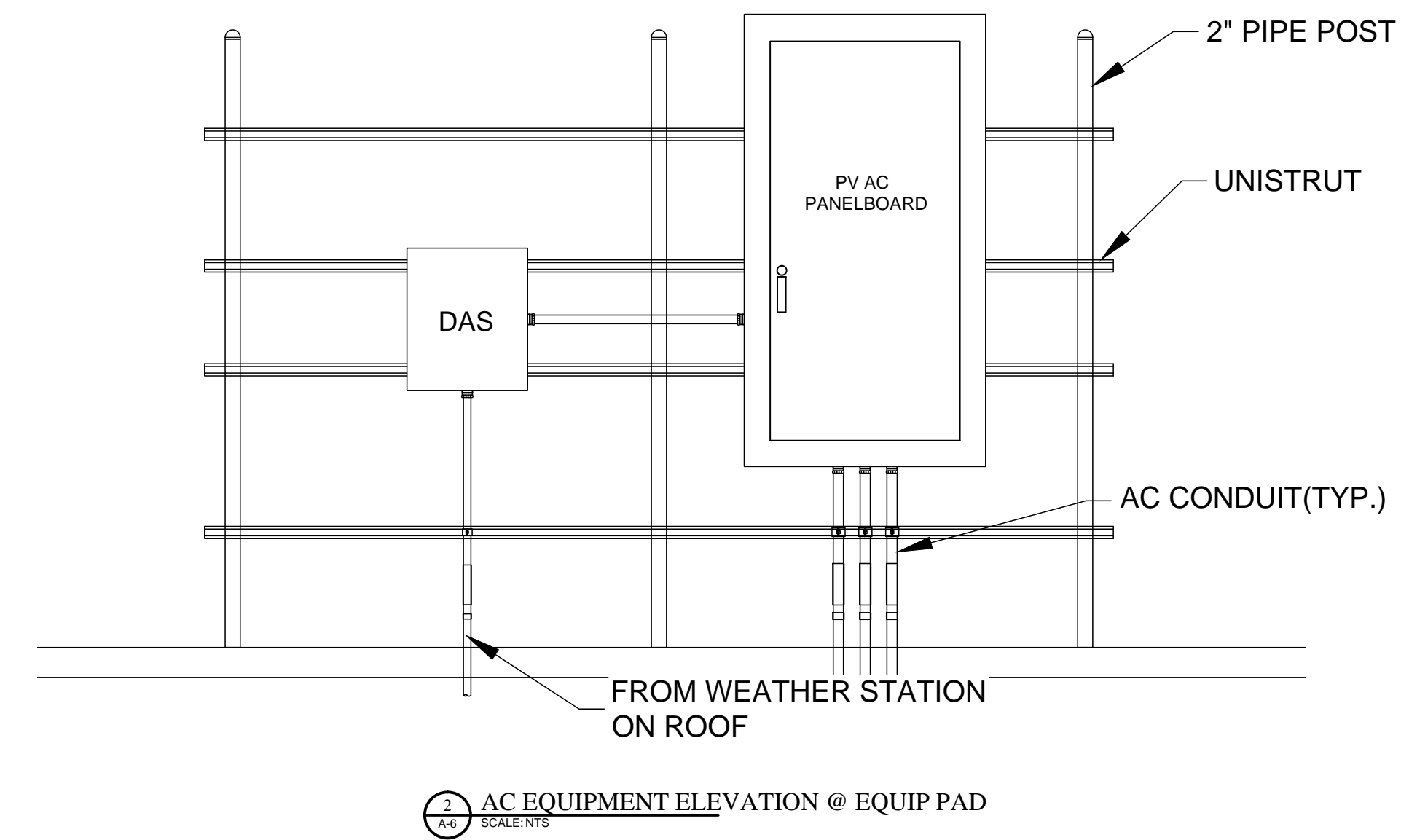
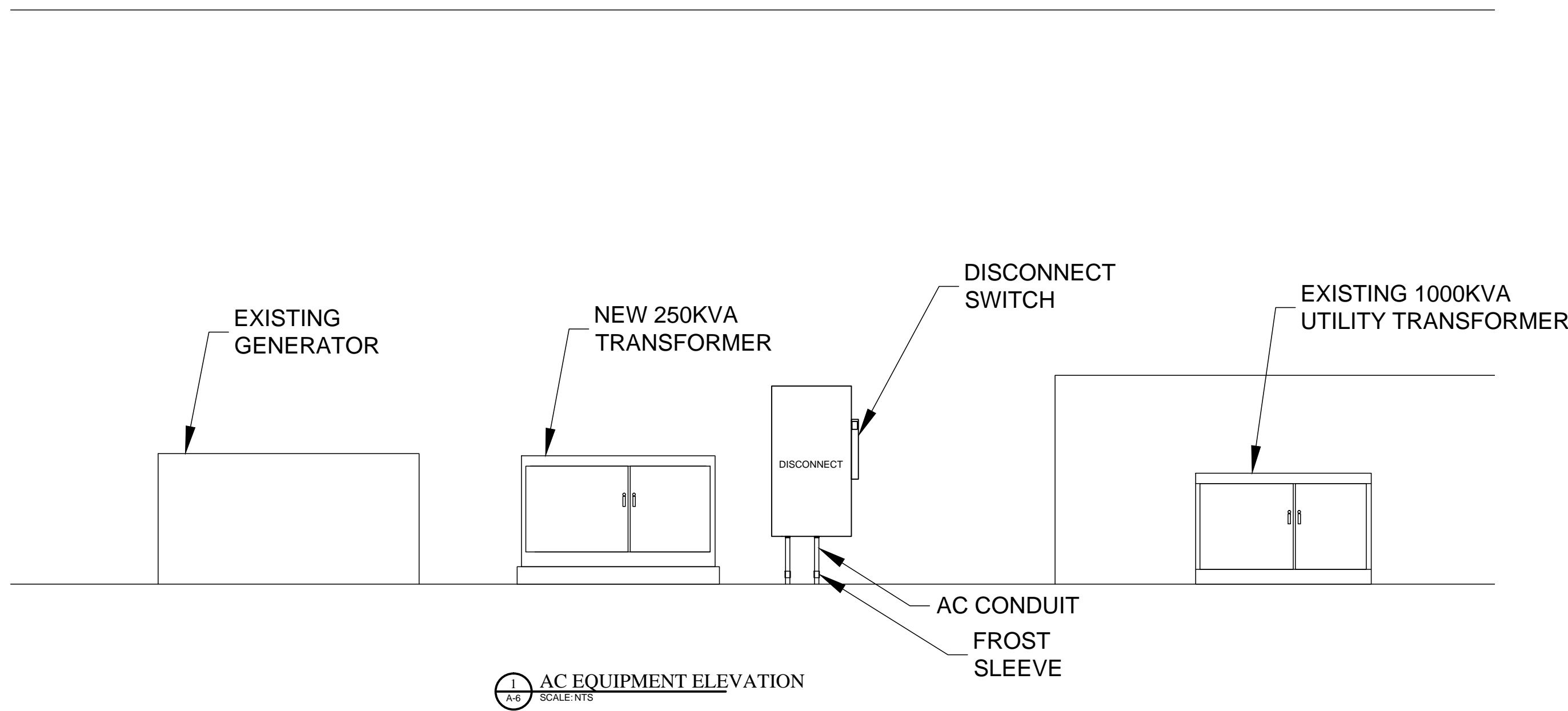












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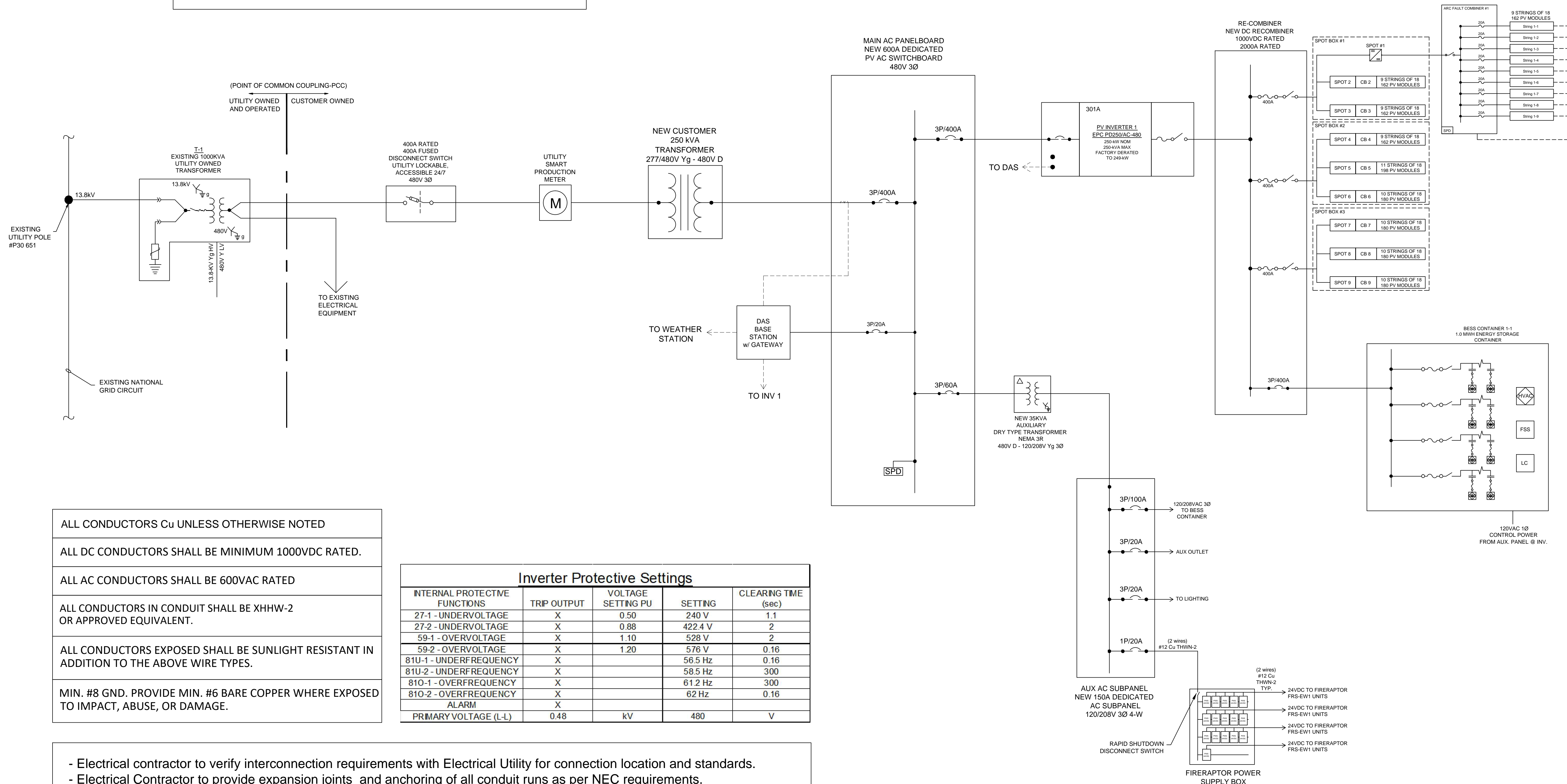




SYSTEM SIZE = 615.87 kW DC  
 249.0 kW AC NOMINAL  
 249.0 kVA AC MAXIMUM  
 W / 1,000kWh DC-COUPLED BESS

(648) ASTONERGY CHSM72M(DG)/F-BH 405W MODULES  
 (918) PHONO SOLAR PS385M-24/TH 385W MODULES  
 (1) EPC PD250/AC-480 INVERTER  
 (9) ALENCON SPOT 1000 DC-DC CONVERTERS

SPOTS #1-4: ASTRONERGY 405W MODULES  
 SPOTS #5-9: PHONO 385W MODULES



- ALL CONDUCTORS Cu UNLESS OTHERWISE NOTED
- ALL DC CONDUCTORS SHALL BE MINIMUM 1000VDC RATED.
- ALL AC CONDUCTORS SHALL BE 600VAC RATED
- ALL CONDUCTORS IN CONDUIT SHALL BE XHHW-2 OR APPROVED EQUIVALENT.
- ALL CONDUCTORS EXPOSED SHALL BE SUNLIGHT RESISTANT IN ADDITION TO THE ABOVE WIRE TYPES.
- MIN. #8 GND. PROVIDE MIN. #6 BARE COPPER WHERE EXPOSED TO IMPACT, ABUSE, OR DAMAGE.

Inverter Protective Settings				
INTERNAL PROTECTIVE FUNCTIONS	TRIP OUTPUT	VOLTAGE SETTING PU	SETTING	CLEARING TIME (sec)
27-1 - UNDERVOLTAGE	X	0.50	240 V	1.1
27-2 - UNDERVOLTAGE	X	0.88	422.4 V	2
59-1 - OVERVOLTAGE	X	1.10	528 V	2
59-2 - OVERVOLTAGE	X	1.20	576 V	0.16
81U-1 - UNDERFREQUENCY	X		56.5 Hz	0.16
81U-2 - UNDERFREQUENCY	X		58.5 Hz	300
81O-1 - OVERFREQUENCY	X		61.2 Hz	300
81O-2 - OVERFREQUENCY ALARM	X		62 Hz	0.16
PRIMARY VOLTAGE (L-L)	0.48	kV	480	V

- Electrical contractor to verify interconnection requirements with Electrical Utility for connection location and standards.
- Electrical Contractor to provide expansion joints and anchoring of all conduit runs as per NEC requirements.
- Provide label/placard at existing utility connection with "WARNING - CUSTOMER OWNED ELECTRICAL GENERATION EQUIPMENT CONNECTED" with appropriate hazard and output ratings of PV System.
- All exterior mounted combiners, junction boxes, troughs, disconnects, etc. shall be minimum NEMA 3R Rated.
- Interconnection to Utility and System Grounding per NEC-2020 Article 690.
- Provide signage as required by NEC-2020 Article 690.
- All outdoor equipment shall be a minimum of NEMA-3R Rated.
- All DC conductors within the Building Envelope must be in metallic conduit.
- All DC conductors must be 90° Rated.
- All DC conductors must be 1000V Rated.
- Confirm line side voltage at electric utility service entrance BEFORE connecting inverter and ensure proper operational range required by system inverter.

**INVERTER 1**  
 PV Modules = 405 Watts STC  
 648 Modules per Inverter = 262,440 watts STC  
 36 strings of 18 PV Modules  
 PV Modules = 385 Watts STC  
 918 Modules per Inverter = 353,430 watts STC  
 51 strings of 18 PV Modules  
 W/ 1,000kWh DC-Coupled BESS

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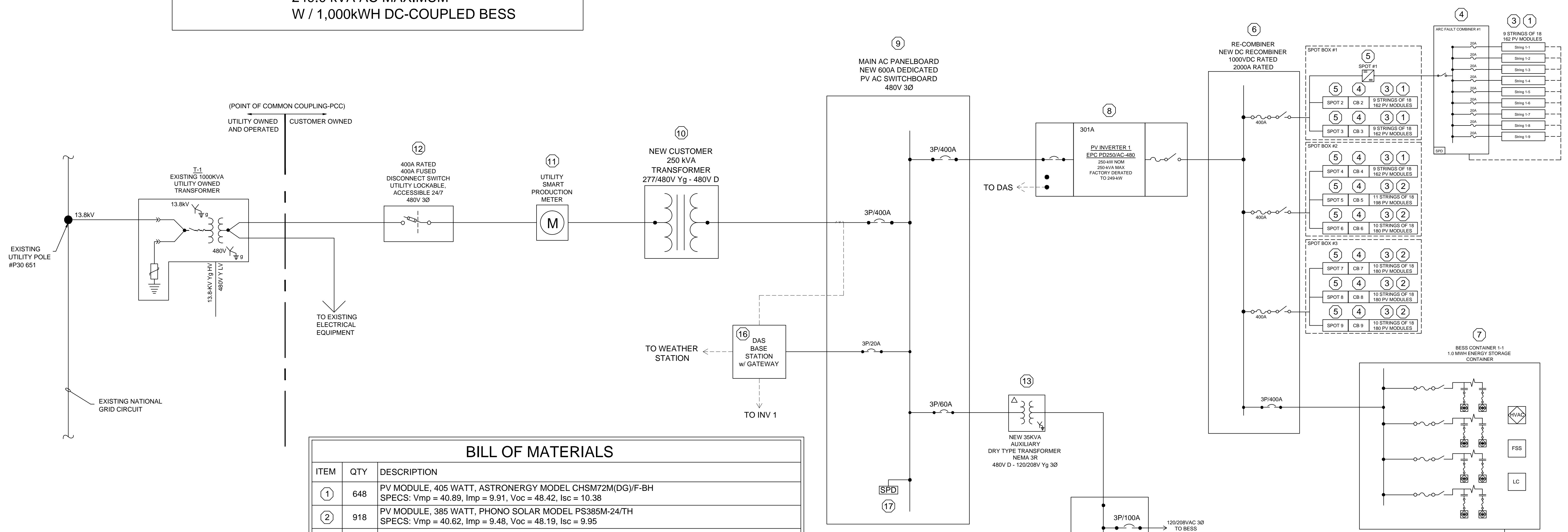
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**BILL OF MATERIALS**

ITEM	QTY	DESCRIPTION
①	648	PV MODULE, 405 WATT, ASTRONERGY MODEL CHSM72M(DG)/F-BH SPECS: Vmp = 40.89, Imp = 9.91, Voc = 48.42, Isc = 10.38
②	918	PV MODULE, 385 WATT, PHONO SOLAR MODEL PS385M-24/TH SPECS: Vmp = 40.62, Imp = 9.48, Voc = 48.19, Isc = 9.95
③	1,566	DC MLPE, FIRERAPTOR FRS-01 SYSTEM (ALSO REQUIRES POWER SUPPLY) MAXIMUM INPUT SPECS: Voc = 75V (Single Mod), Imax = 12A, ISCmax = 15A MAXIMUM OUTPUT SPECS: VDC = 75-Voc (Single Mod), ADC = 12A
④	9	ALENCON SPOT-1000 DC-DC CONVERTER, 19.2kW, 19.2Adc MAX CURRENT PER OUTPUT, 1000Vdc SOLAR INPUT, 1000V DC COMMON, BUS OUTPUT, CONFIGURED FOR DC COUPLED BATTERY INTEGRATION
⑤	5	C1000VDC ARC FAULT COMBINER, 32 SPACES, 30A FUSES (+ POLE), 90C TERMINALS, 800A CONTINUOUS DUTY RATED DISCONNECT SWITCH, NEMA4
⑥	1	1000V DC BUSBAR, MIN 2000A RATING, FUSED DISCONNECTS AS NOTED, NEMA3R
⑦	1	ENEON-ES BATTERY ENERGY STORAGE SYSTEM WITH LG CHEM STACKS (SD22L417F_G16D2A3), 1.0MWhr, 714-999 VDC, CONTAINERIZED, UL9540 CERTIFIED w/ (4) ALENCON BOSS-1000 DC-DC CONVERTER, 77kW, 77Adc MAX CURRENT PER OUTPUT, 1000Vdc BATTERY INPUT, 1000V DC COMMON BUS OUTPUT, CONFIGURED FOR BATTERY INTEGRATION
⑧	1	PV/BESS INVERTER, 250 kW, 720-1000 VDC, 301A CONTINUOUS OUTPUT, 480V 3-PHASE DELTA OUTPUT, INTEGRATED DC AND AC DISCONNECT, NEMA3R ENCLOSURE EPC PD250/AC-480 BATTERY INVERTER
⑨	1	MAIN AC COMBINER PANELBOARD, 480V, 400A MAIN BREAKER WITH 600A BUSBAR, BRANCH BREAKERS AS NOTED, NEMA3R
⑩	1	NEW CUSTOMER OWNED 250kVA PAD MOUNTED TRANSFORMER, 480VAC DELTA SECONDARY, 277/480V Yg PRIMARY
⑪	1	CUSTOMER OWNED METER SOCKET FOR UTILITY OWNED SMART PROGRAM METER FOR CANOPY, 320A CONT. DUTY, SELF CONTAINED, 7-JAW W/ BYPASS LEVER, MILBANK U7573-RL OR EQUIV., SMART PROGRAM METER
⑫	1	UTILITY REQUIRED EXTERNAL AC DISCONNECT, 277/480V, 400A BLADE W/ 400A FUSES, LOCKABLE, VISIBLE BREAK, NEMA3R, ACCESSIBLE 24/7, RATED FOR USE AS SERVICE
⑬	1	AUXILIARY DRY-TYPE TRANSFORMER, 50kVA, 480D-120/208Y, NEMA3R
⑭	1	AC AUXILIARY PANEL, 120/208V 3P-4W, 200A RATED MLO, BREAKERS AS NOTED, NEMA 3R
⑮	1	FIRERAPTOR POWER SUPPLY BOX, (16) MPS-1-060-24DC POWER SUPPLIES, 120VDC INPUT, 24VDC OUTPUT, INTEGRATED RAPID SHUTDOWN DISCONNECT SWITCH
⑯	1	DAS FOR PV SYSTEM PRODUCTION, INVERTER DIRECT DATA, AND AMBIENT WEATHER COND.
⑰	1	480 3P SURGE PROTECTION DEVICE (INTEGRATED IF AVAILABLE)

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 225 BODWELL ST.  
 225 BODWELL ST.  
 AVON, MA 02322

JAMES A. CLANCY  
 MA PE 06775

**REVISIONS**

DATE	COMMENT
05-04-20	INCREASE DC SIZE
05-12-20	INVERTER CHANGE / ESS
05-20-20	ADDITIONAL ACCESS
05-20-20	DC CONFIG EDITED
07-31-20	LAYOUT CHANGE
11-16-21	MOD/DC CONFIG CHANGE

JOB #	RCA
DRWN	RCA
CHKD	JAC
SCALE	AS NOTED
DATE	03-19-2020



DC & 1Ø VOLTAGE DROP EXAMPLE CALC.

$$\text{VOLTAGE DROP} = \frac{2 \times K \times I \times L}{\text{cmil}}$$

EXAMPLE CALC. USING 11A WITH #10 XHHW WIRE WITH 100' RUN

$$\text{VOLTAGE DROP} = \frac{2 \times 12.9 \times 11 \times 100}{10,380}$$

VOLTAGE DROP = 2.73 VOLTS

VOLTAGE DROP % = (2.73/840) x 100

VOLTAGE DROP % = 0.32%

3Ø VOLTAGE DROP EXAMPLE CALC.

$$\text{VOLTAGE DROP} = \frac{1.732 \times K \times I \times L}{\text{cmil}}$$

EXAMPLE CALC. USING 240A WITH 350 Kcmil XHHW WIRE WITH 100' RUN

$$\text{VOLTAGE DROP} = \frac{1.732 \times 12.9 \times 240 \times 100}{350,000}$$

VOLTAGE DROP = 1.532 VOLTS

VOLTAGE DROP % = (1.532/480) x 100

VOLTAGE DROP % = 0.32%

Ampacity of 90° #10 PV Wire per NEC 2020 Table 310.15(B)(16) = **40 Amps**

Wareham, MA ASHRAE 2% High Temperature = **32°C**

Maximum temperature of conduit = **32°C**

31°C - 35° ampacity temp. correction factor per NEC 2020 table 310.15(B)(2)(a) = **0.96 or 96%**

7-9 conductors in conduit temp. correction factor per NEC 2020 table 310.15(B)(3)(a) = **.7 or 70%**

Maximum Fire Raptor FRS-01 MLPE output current = **15 Amps**

125% of MLPE output current for OCPD = **18.75 Amps**

Calculation:

40A \* 0.96 correction \* .7 correction = **26.9 Amps**

**26.9 Amp wire rating > 18.75 Amp MLPE OCPD**

#10 AWG PV Wire is acceptable for use for the DC wiring of the PV Inverter for 7-9 conductors in one conduit.

**LEGEND**

K = ohms-cmil per foot

I = current (or amperes) of load

L = length of conductor in ft. (one-way)

cmil = circular mil area of the conductor

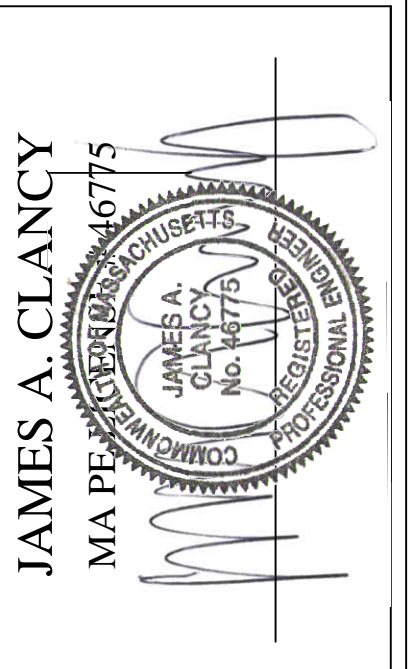
**DERATING FOR AMBIENT TEMP.**

AMPACITY TABLE USED IS NEC TABLE 310.15(B)(16) WHICH USES 30° C. 2% HIGH AMBIENT TEMPERATURE OF LOCATION IS 32° C. AMPACITY CORRECTION FACTOR FOR 31°-35° C IS 0.96 (96%).

**ARC DESIGN**  
 409 NORTH MAIN STREET  
 ELMER, NJ 08318  
 (856) 712-2166 FAX: (856) 358-1511

PREPARED FOR:  
**NextGrid**  
 PO BOX 7775 #73069  
 SAN FRANCISCO, CA 94120

PROPOSED PHOTOVOLTAIC ARRAY  
 225 BODWELL ST.  
 225 BODWELL ST.  
 AVON, MA 02322



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JOB #	
DRWN	RCA
CHKD	JAC
SCALE	AS NOTED
DATE	03-19-2020

**E-1.3**



PV DC Strings to Combiner Boxes										
	# of Strings	Module Count	DC + / DC -	GND	Conduit	Imp	Isc	ISC * 156%	Length	Voltage Drop @ 978.94VMP
DC COMBINER 1	9	162	(18) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.91	10.38	16.1928	Avg. 200'	0.50%
DC COMBINER 2	9	162	(18) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.91	10.38	16.1928	Avg. 200'	0.50%
DC COMBINER 3	9	162	(18) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.91	10.38	16.1928	Avg. 200'	0.50%
DC COMBINER 4	9	162	(18) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.91	10.38	16.1928	Avg. 200'	0.50%
	# of Strings	Module Count	DC + / DC -	GND	Conduit	Imp	Isc	ISC * 156%	Length	Voltage Drop @ 981.92VMP
DC COMBINER 5	11	198	(22) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.48	9.95	15.522	Avg. 200'	0.48%
DC COMBINER 6	10	180	(20) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.48	9.95	15.522	Avg. 200'	0.48%
DC COMBINER 7	10	180	(20) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.48	9.95	15.522	Avg. 200'	0.48%
DC COMBINER 8	10	180	(20) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.48	9.95	15.522	Avg. 200'	0.48%
DC COMBINER 9	10	180	(20) #10 PV WIRE	# 6 AWG Cu	1 1/2" (Max 7 strings)	9.48	9.95	15.522	Avg. 200'	0.48%

PV DC Combined Strings to SPOT DC-DC Converters										
	# of Strings	Module Count	DC + / DC -	GND	Conduit	Imp	Isc	ISC * 156%	Length	Voltage Drop @ 978.94VMP
DC COMBINER 1	9	162	(2) 2/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	89.19	93.42	145.7352	100'	0.23%
DC COMBINER 2	9	162	(2) 2/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	89.19	93.42	145.7352	155'	0.36%
DC COMBINER 3	9	162	(2) 2/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	89.19	93.42	145.7352	155'	0.36%
DC COMBINER 4	9	162	(2) 2/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	89.19	93.42	145.7352	60'	0.14%
	# of Strings	Module Count	DC + / DC -	GND	Conduit	Imp	Isc	ISC * 156%	Length	Voltage Drop @ 981.92VMP
DC COMBINER 5	11	198	(2) 3/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	104.28	109.45	170.742	85'	0.23%
DC COMBINER 6	10	180	(2) 3/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	94.8	99.5	155.22	155'	0.38%
DC COMBINER 7	10	180	(2) 3/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	94.8	99.5	155.22	245'	0.60%
DC COMBINER 8	10	180	(2) 3/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	94.8	99.5	155.22	240'	0.59%
DC COMBINER 9	10	180	(2) 3/0 AI PV WIRE	# 6 AWG Cu	1 1/2"	94.8	99.5	155.22	310'	0.76%

SPOT DC-DC Converters and Battery Storage to Main Re-combiner							
	DC + / DC -	GND	Conduit	Max Current	Fuse Size (+ & -)	Length	Voltage Drop @ 1000V
SPOT 1 - SPOT 3	(2) 500kcmil AI PV WIRE	#3 AWG Cu	3"	230.4	315A	60'	0.12%
SPOT 4 - SPOT 6	(2) 500kcmil AI PV WIRE	#3 AWG Cu	3"	230.4	315A	60'	0.12%
SPOT 7 - SPOT 9	(2) 500kcmil AI PV WIRE	#3 AWG Cu	3"	230.4	315A	60'	0.12%

Re-combiner to DC-DC Converter							
	DC + / DC -	GND	Conduit	Max Current	Fuse Size (+ & -)	Length	Voltage Drop @ 1000V
INVERTER 1	(4) 500kcmil AI PV WIRE	1/0 AWG Cu	(2) 3"	500A	630A	15'	0.02%

Auxiliary WRING									
LINE START	LINE END	Voltage / Type	Conductor	Neutral	Gnd	CONDUIT	AC LOAD	AC OVERCURRENT	LENGTH (FT)
Aux. Loads Panel	Aux. Transformer	120/208V AC 3 PH	3/0 Cu	3/0 Cu	#6 Cu	2"	N/A	200	5
Aux. Transformer	Aux. Disconnect	480V AC 3 PH	#6 Cu	N/A	#10 Cu	1"	N/A	60	5
Aux. Disconnect	Transformer (LV)	480V AC 3 PH	#6 Cu	N/A	#10 Cu	1"	N/A	60	5
Aux. Loads Panel	BESS Container	120/208V AC 3 PH	#3 Cu	#3 Cu	#6 Cu	1 1/4"	N/A	100A	15

AC WRING									
LINE START	LINE END	L1, L2, L3	N	GND	CONDUIT	AC LOAD	AC OVERCURRENT	LENGTH (FT)	VOLT. DROP @ LOAD
Inverter 1	Panelboard	(2) 250kcmil AI	(2) 250kcmil AI	#3 Cu	(2) 2"	301.00	376	10	0.05%
Panelboard	Customer Transformer	(2) 250kcmil AI	(2) 250kcmil AI	#3 Cu	(2) 2"	301.00	376	90	0.41%
Customer Transformer	Smart Meter	(2) 250kcmil AI	(2) 250kcmil AI	#3 Cu	(2) 2"	301.00	376	10	0.05%
Smart Meter	PV AC Disconnect	(2) 250kcmil AI	(2) 250kcmil AI	#3 Cu	(2) 2"	301.00	376	5	0.02%
PV AC Disconnect	Utility Transformer	(2) 250kcmil AI	(2) 250kcmil AI	#3 Cu	(2) 2"	301.00	376	10	0.05%

(4) Indicates 4 parallel sets, (3) indicates 3 parallel sets, (2) indicates 2 parallel sets for AC wiring & total number of wires for DC wiring  
 All DC wiring shall be 2000V & 90°C rated  
 All Conduits may be Sched 40 PVC or Rigid Galvanized at contractors option & in compliance with local codes.  
 All Conduits susceptible to physical damage shall be Sched 80 PVC or Rigid Galvanized  
 Supports and expansions shall be placed as per NEC 2020 requirements.  
 LFNC-B is acceptable for use where flexibility is needed.

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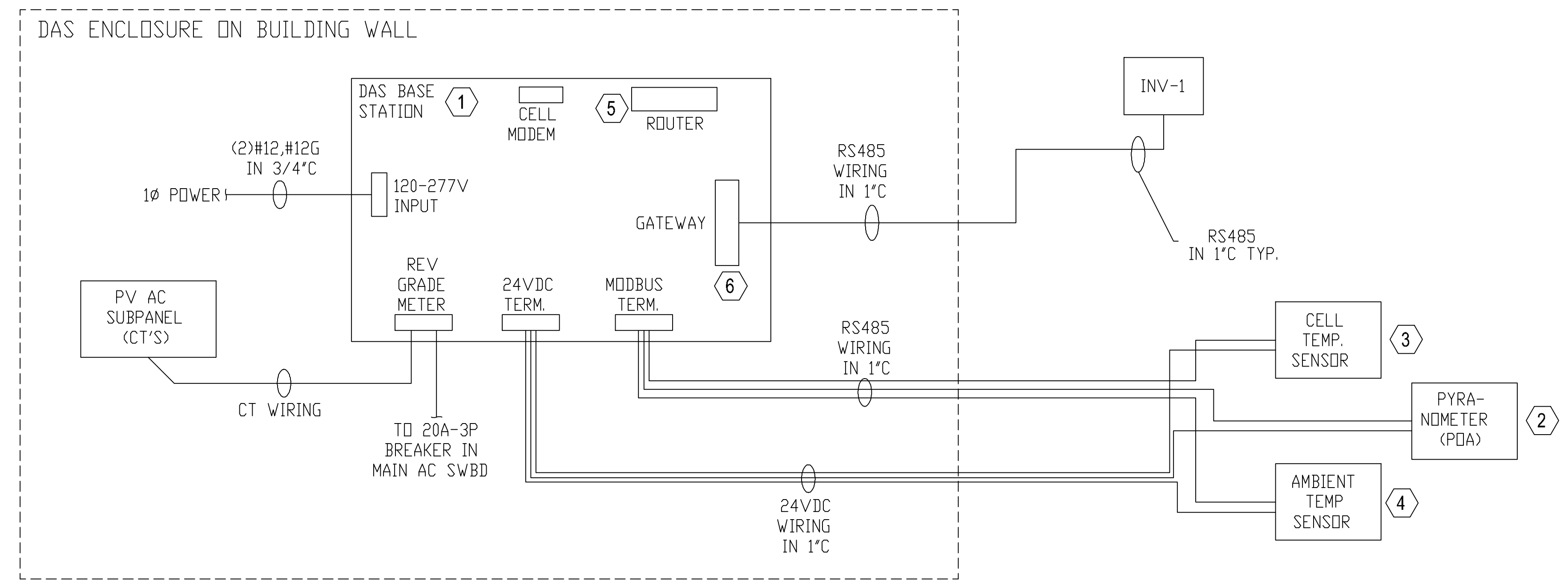
JOB #	
DRWN	RCA
CHKD	JAC
SCALE	AS NOTED
DATE	03-19-2020

**E-1.4**



REVISIONS	
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JOB #	
DRWN	RCA
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SCALE	AS NOTED
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**KEYED DRAWING NOTES:**

- ① DAS BASE STATION TO BE MOUNTED ADJACENT TO PANELBOARD.
- ② PLANE OF ARRAY PYRANOMETER TO BE MOUNTED TO RACKING NEAR TOP ROW
- ③ CELL TEMPERATURE SENSOR TO BE POSITIONED INTERNAL TO THE ARRAY AND MOUNTED TO THE CENTER OF A MODULE CELL ON CENTER OF ONE THE MODULES NEAR TOP OF ARRAY.
- ④ AMBIENT TEMPERATURE SENSOR TO BE MOUNTED ON NORTH SIDE OF RACKING SYSTEM.
- ⑤ MULTI PORT ROUTER TO BE INSTALLED IN MAIN DAS CABINET AND POWERED FROM THE DAS 24VDC POWER POWER SUPPLY.
- ⑥ GATEWAY TO BE INSTALLED IN MAIN DAS CABINET AND POWERED FROM THE DAS 24VDC POWER POWER SUPPLY.

**GENERAL NOTES:**

- 1. ALL CABLING TO BE INSTALLED IN A 1" MIN CONDUIT.
- 2. REFER TO THE FINAL DAS PROVIDER WIRING DIAGRAMS FOR EXACT CONFIGURATION AND WIRING REQUIREMENTS FOR THE SYSTEM.

**1 DAS BASE STATION**  
 E-1.5 SCALE: NTS



**⚠ WARNING**  
**ELECTRIC SHOCK HAZARD**  
 IF A GROUND FAULT IS INDICATED NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED

LABEL LOCATION:  
 DC DISCONNECT, INVERTER  
 (PER CODE: NEC 690.35(F))  
 [To be used when inverter is ungrounded]

**⚠ WARNING**  
**ELECTRIC SHOCK HAZARD**  
 DO NOT TOUCH TERMINALS TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

DC VOLTAGE IS ALWAYS PRESENT WHEN SOLAR MODULES ARE EXPOSED TO SUNLIGHT

LABEL LOCATION:  
 AC DISCONNECT, POINT OF INTERCONNECTION  
 (PER CODE: NEC 690.17(E))

**INVERTER 1**

3" x 1" PLACARD (QTY. 1)  
 APPLY TO:  
 INVERTER #1

**COMBINER #**

3" x 1" PLACARD (QTY. 9)  
 APPLY TO:  
 COMBINER #1-9

**PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN**

**CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED**

LABEL LOCATION:  
 POINT OF INTERCONNECTION  
 (PER CODE: CEC690.15, 690.13(B))

PHOTOVOLTAIC SYSTEM  
 AC DISCONNECT  
 AC OPERATING OUTPUT CURRENT: 301A  
 NOMINAL AC OPERATING VOLTAGE: 480V

**WARNING:**  
 ELECTRIC SHOCK HAZARD  
 AUTHORIZED PERSONNEL ONLY  
 DO NOT TOUCH TERMINALS, BOTH LINE AND LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION

5" x 3" PLACARD (QTY. 1)  
 APPLY TO:  
 MAIN AC DISCONNECT

**⚠ DANGER**  
**ARC FLASH AND SHOCK HAZARD**  
 FOLLOW ALL REQUIREMENTS IN NFPA 70E FOR SAFE WORK PRACTICES AND FOR PERSONAL PROTECTION EQUIPMENT

LABEL LOCATION:  
 PV PANELS, DISCONNECTS, INVERTERS  
 (PER CODE: NEC 690.35(F))

**⚠ WARNING**  
**ELECTRIC SHOCK HAZARD**  
 THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED

LABEL LOCATION:  
 DC DISCONNECT, INVERTER  
 (PER CODE: NEC 690.35(F))  
 [To be used when inverter is ungrounded]

**CAUTION:**  
**SOLAR ELECTRIC SYSTEM CONNECTED**

5" x 3" PLACARD (QTY. 1)  
 APPLY TO:  
 MAIN METER CABINET  
 MAIN DISCONNECT

**⚠ WARNING**  
**ELECTRIC SHOCK HAZARD**  
 DO NOT TOUCH TERMINALS TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

LABEL LOCATION:  
 AC DISCONNECT, POINT OF INTERCONNECTION

**SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN**

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY

**CAUTION: SOLAR CIRCUIT**

LABEL LOCATION:  
 MARKINGS PLACED ON ALL INTERIOR AND EXTERIOR DC CONDUIT, RACEWAYS, ENCLOSURES, AND CABLE ASSEMBLIES AT LEAST EVERY 10 FT, AT TURNS AND ABOVE/BELOW PENETRATIONS AND ALL COMBINER/JUNCTION BOXES. (PER CODE: IFC605.11.1.4)

**WARNING: PHOTOVOLTAIC POWER SOURCE**

LABEL LOCATION:  
 CONDUIT, COMBINER BOX  
 (PER CODE: NEC690.31(G)(3)(4) & NEC 690.13(G)(4))

ADHESIVE FASTENED SIGNS:  
 THE LABEL SHALL BE SUITABLE FOR THE ENVIRONMENT WHERE IT IS INSTALLED. WHERE REQUIRED ELSEWHERE IN THIS CODE, ALL FIELD APPLIED LABELS, WARNINGS, AND MARKINGS SHOULD COMPLY WITH ANSI Z535.4 [NEC 110.21(B) FIELD MARKING]. ADHESIVE FASTENED SIGNS MAY BE ACCEPTABLE IF PROPERLY ADHERED. VINYL SIGNS SHALL BE WEATHER RESISTANT [IFC 605.11.1.3]

**⚠ WARNING DUAL POWER SOURCE SECOND SOURCE IS PHOTOVOLTAIC SYSTEM**

LABEL LOCATION:  
 POINT OF INTERCONNECTION AND TRANSFORMER LABEL  
 (PER CODE: CEC 705.12(D)(4))

**DIRECT CURRENT PHOTOVOLTAIC POWER SOURCE**

MAXIMUM VOLTAGE  
978.94 VDC

MAXIMUM CIRCUIT CURRENT  
116.78 AMPS

MAXIMUM RATED CHARGE CONTROLLER OUTPUT  
N/A

4" x 4" PLACARD (QTY. 4)  
 APPLY TO:  
 DC DISCONNECT @ DC COMBINER #1-4

**DIRECT CURRENT PHOTOVOLTAIC POWER SOURCE**

MAXIMUM VOLTAGE  
981.92 VDC

MAXIMUM CIRCUIT CURRENT  
136.81 AMPS

MAXIMUM RATED CHARGE CONTROLLER OUTPUT  
N/A

4" x 4" PLACARD (QTY. 1)  
 APPLY TO:  
 DC DISCONNECT @ DC COMBINER #5

**DIRECT CURRENT PHOTOVOLTAIC POWER SOURCE**

MAXIMUM VOLTAGE  
981.92 VDC

MAXIMUM CIRCUIT CURRENT  
194.03 AMPS

MAXIMUM RATED CHARGE CONTROLLER OUTPUT  
N/A

4" x 4" PLACARD (QTY. 4)  
 APPLY TO:  
 DC DISCONNECT @ DC COMBINER #6-9

PER CODE: NEC 690.17(E), CB

**DIRECT CURRENT PHOTOVOLTAIC POWER SOURCE**

MAXIMUM VOLTAGE  
1000 VDC

MAXIMUM CIRCUIT CURRENT  
1,101.41 AMPS

MAXIMUM RATED CHARGE CONTROLLER OUTPUT  
216

4" x 4" PLACARD (QTY. 1)  
 APPLY TO:  
 DC DISCONNECT @ DC RECOMBINER

**⚠ WARNING**  
**Arc Flash and Shock Risk**  
**Appropriate PPE Required**

30 in Arc Flash Boundary  
 2.65 cal/cm<sup>2</sup> Incident Energy at 18 in

PPE Arc-rated shirt & pants or arc-rated coverall or arc-rated arc flash suit

208 VAC Shock Risk when cover is removed

00 Glove Class

42 in Limited Approach

12 in Restricted Approach

Location: AUX PANELBOARD BUS

**⚠ WARNING**  
**Arc Flash and Shock Risk**  
**Appropriate PPE Required**

8 in Arc Flash Boundary  
 0.36 cal/cm<sup>2</sup> Incident Energy at 18 in

PPE No Arc-rated PPE Required

480 VAC Shock Risk when cover is removed

00 Glove Class

42 in Limited Approach

12 in Restricted Approach

Location: PANELBOARD BUS

**⚠ WARNING**  
**Arc Flash and Shock Risk**  
**Appropriate PPE Required**

32 in Arc Flash Boundary  
 3.02 cal/cm<sup>2</sup> Incident Energy at 18 in

PPE Arc-rated shirt & pants or arc-rated coverall or arc-rated arc flash suit

480 VAC Shock Risk when cover is removed

00 Glove Class

42 in Limited Approach

12 in Restricted Approach

Location: PV AC DISCO BUS

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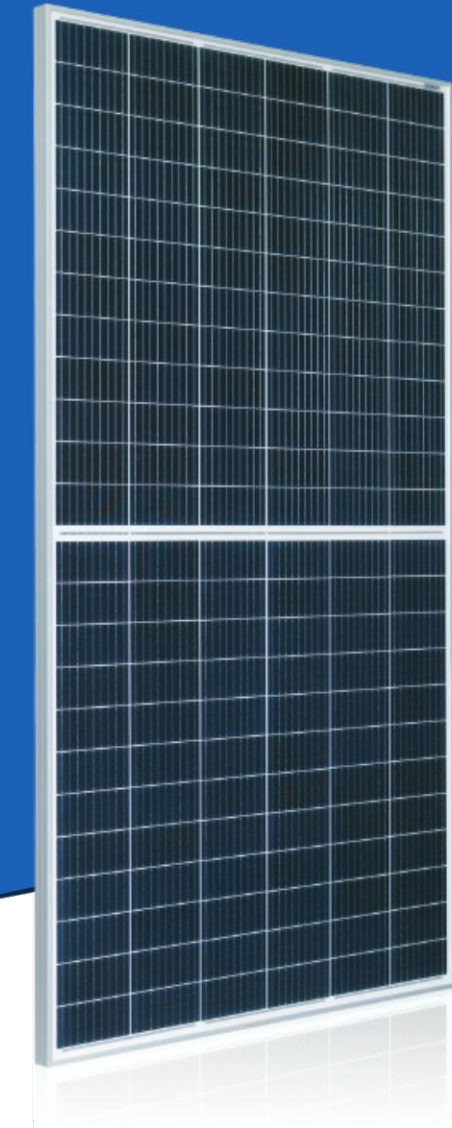






# AstroTwins™

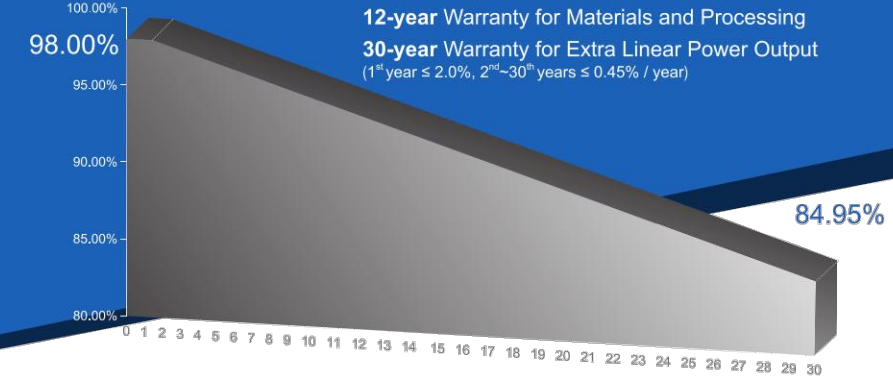
Enjoy the Energy of the Universe



## 405W~420W

P-type Monocrystalline PV Module  
CHSM72M(DG)/F-BH Series (158.75)

CHSM72M(DG)/F-BH is bifacial module with white glazed glass



### KEY FEATURES

- 5W OUTPUT POSITIVE TOLERANCE**  
Guaranteed 0~+5W positive tolerance ensures power output reliability.
- EXCELLENT WEATHER RESISTANCE**  
Reduces the cell micro-crack and extended product warranty.
- BIFACIAL POWER**  
The backside makes use of the reflected and scattered light from the surroundings, the modules can yield up to 30%~35% power more, depending on the albedo.
- REDUCE INTERNAL MISMATCH LOSS**  
Reduces mismatch loss and improves output.
- APPLICABLE FOR MULTI DIFFERENT ENVIRONMENTS**  
The wide range of applications, such as BIPV, vertical installation, snow area, high humidity area and strong sandstorm area, etc.
- SNAIL TRAIL RESISTANCE**  
Reduces the probability of snail trails with zero water vapor transmittance.

### COMPREHENSIVE CERTIFICATES



First solar company which passed the TUV Nord IEC/TS 62941 certification audit.

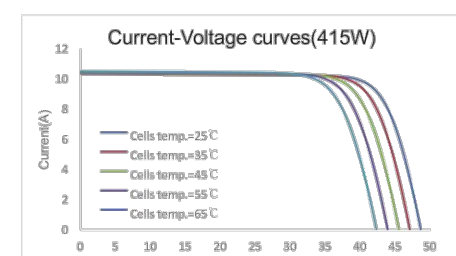
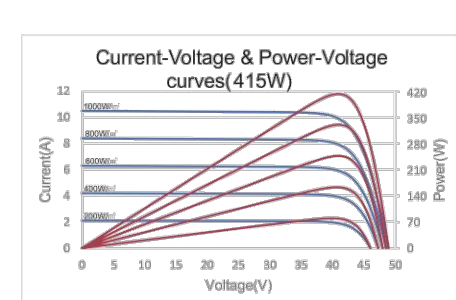
For Global Market



ELECTRICAL SPECIFICATIONS						
Power rating (front)	405 Wp		410 Wp		415 Wp	
Testing Condition	Front	Back	Front	Back	Front	Back
STC rated output (P <sub>max</sub> )*	405	285	410	289	415	292
Rated voltage (V <sub>mp</sub> ) at STC	40.89	41.10	41.10	41.31	41.31	41.52
Rated current (I <sub>mp</sub> ) at STC	9.91	6.94	9.98	6.99	10.05	7.04
Open circuit voltage (V <sub>oc</sub> ) at STC	48.42	46.99	48.60	47.17	48.78	47.34
Short circuit current (I <sub>sc</sub> ) at STC	10.38	7.28	10.46	7.33	10.54	7.39
Module efficiency	19.7%	13.8%	19.9%	14.0%	20.2%	14.2%
Temperature coefficient (P <sub>max</sub> )	-0.35%/°C					
Temperature coefficient (I <sub>sc</sub> )	+0.06%/°C					
Temperature coefficient (V <sub>oc</sub> )	-0.28%/°C					
Nominal module operating temperature (NMOT)	44±2°C					
Maximum system voltage (IECUL)	1500V <sub>DC</sub>					
Number of diodes	3					
Junction box IP rating	IP 68					
Maximum series fuse rating	20 A					

STC: Irradiance 1000W/m<sup>2</sup>, Cell Temperature 25°C, AM=1.5

### CURVE



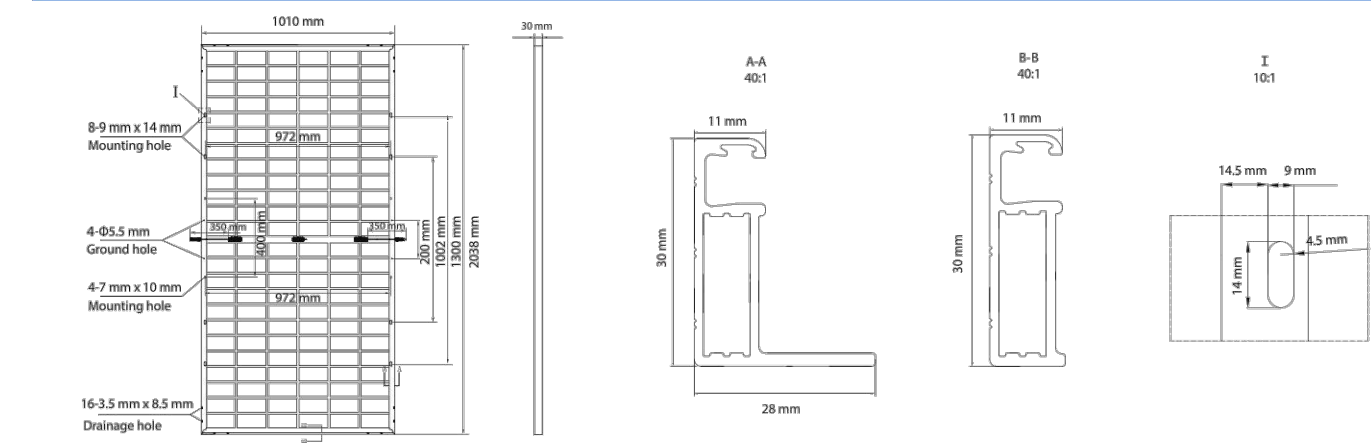
ELECTRICAL SPECIFICATIONS (Integrated power)						
P <sub>mp</sub> gain	P <sub>mp</sub>	V <sub>mp</sub>	I <sub>mp</sub>	V <sub>oc</sub>	I <sub>sc</sub>	
5%	436 Wp	41.31 V	10.55 A	48.78 V	11.07 A	
10%	457 Wp	41.31 V	11.05 A	48.78 V	11.59 A	
15%	477 Wp	41.21 V	11.58 A	48.88 V	12.12 A	
20%	498 Wp	41.21 V	12.08 A	48.88 V	12.65 A	
25%	519 Wp	41.21 V	12.59 A	48.88 V	13.18 A	

Electrical characteristics with different rear power gain (reference to 415W)

MECHANICAL SPECIFICATIONS	
Outer dimensions (L x W x H)	2038 x 1010 x 30 mm
Frame technology	Aluminum, silver anodized
Glass thickness	2.0 mm
Cable length (IECUL)	Portrait: 350 mm Landscape: 1200 mm
Cable diameter (IECUL)	4 mm / 12 AWG
Maximum mechanical test load	5400 Pa (front) / 2400 Pa (back)
Connector type (IECUL)	MC4 compatible

PACKING SPECIFICATIONS	
Weight (module only)	25.3 kg
Packing unit	36 pcs / box
Weight of packing unit (for 40HQ container)	994 kg
Number of modules per 40HQ container	792 pcs

### MODULE DIMENSION DETAILS



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http://energy.chint.com

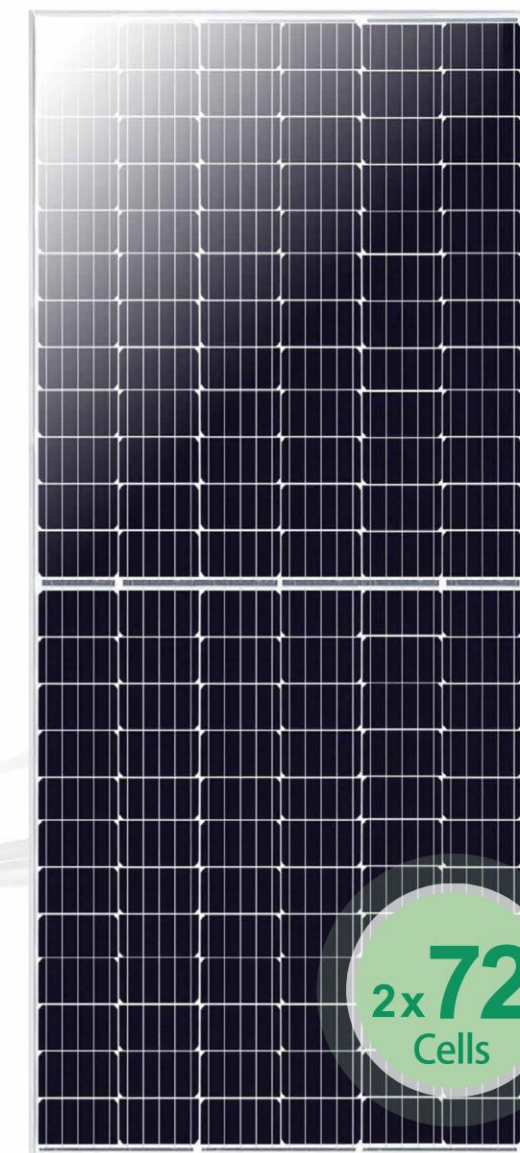
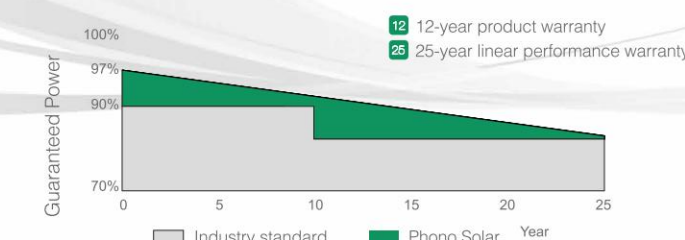
Astronergy 05-2020

# Phono® Solar

## TwinPlus Module

Perc/370-385W

- PID Resistant**
- Better shading tolerance**
- More Reliable**  
Lower hot spot temperature
- More Power**  
Low power loss in cell connection  
Low temperature coefficient (P<sub>max</sub>): -0.38% / °C  
Low NOCT: 43±2°C



2x72 Cells



EN-20190514



ELECTRICAL TYPICAL VALUES				
Model	PS370M-24/TH PS370MH-24/TH	PS375M-24/TH PS375MH-24/TH	PS380M-24/TH PS380MH-24/TH	PS385M-24/TH PS385MH-24/TH
Type	Monocrystalline 6 inch x 3 inch square			
Rated Power (P <sub>mp</sub> )	370W	375W	380W	385W
Tolerance	0~+5w			
Rated Current (I <sub>mp</sub> )	9.29	9.35	9.42	9.48
Rated Voltage (V <sub>mp</sub> )	39.83	40.11	40.35	40.62
Short Circuit Current (I <sub>sc</sub> )	9.71	9.79	9.87	9.95
Open Circuit Voltage (V <sub>oc</sub> )	47.44	47.69	47.94	48.19
Module Efficiency (%)	18.65	18.90	19.15	19.41
NOCT (Nominal Operation Cell Temperature)	43±2°C			
Voltage Temperature Coefficient	-0.30%/°C			
Current Temperature Coefficient	+0.05%/°C			
Power Temperature Coefficient	-0.38%/°C			

MECHANICAL CHARACTERISTICS		ELECTRICAL CHARACTERISTICS	
Length: 2000mm (78.75 inch)	Width: 992mm (39.06 inch)	Operating Temperature	From -40 to +85°C
Dimension (L x W x H)	Height: 40mm (1.57 inch)	Hall Diameter	Up to 25mm
Weight	22.6kg (49.8 lbs)	Surface Maximum Load Capacity	Up to 5400Pa
Front Glass	3.2mm toughened glass	Maximum Series Fuse Rating	20A
Frame	Anodized aluminum alloy	Application Class and Safety Class	II
Cable	4mm <sup>2</sup> (IEC), Length: 350mm (vertical) 1250mm (horizontal) or Customized length	Fire Rating (IEC61730)	C
Junction Box	IP 68 rated	Module Fire Performance (UL 1703)	Type1
		Maximum System Voltage	DC 1000V/1500V (IEC/ETL)

ABSOLUTE MAXIMUM RATING	
Parameter	Values
Operating Temperature	From -40 to +85°C
Hall Diameter	Up to 25mm
Surface Maximum Load Capacity	Up to 5400Pa
Maximum Series Fuse Rating	20A
Application Class and Safety Class	II
Fire Rating (IEC61730)	C
Module Fire Performance (UL 1703)	Type1
Maximum System Voltage	DC 1000V/1500V (IEC/ETL)

PACKING CONFIGURATION	
Container	20' GP 40' HQ
Pieces/Container	230 616

1. In compliance with our warranty terms and conditions.  
2. Measurement conditions under irradiance level of Standard Test Conditions (STC): 1000W/m<sup>2</sup>  
Air mass 1.5 Spectrum, cell temperature of 25°C.



Note: This datasheet is not legally binding. Phono Solar Technology Co., Ltd. reserves the right to adjust specifications without notice. Further information please refer to our Website: www.phonosolar.com, E-mail: info@phonosolar.com



## FireRaptor Solar Panel Rapid Shutdown Safety Solution



Technical Specification	
Emergency Shutdown Cable	2x1mm <sup>2</sup> cable + Tyco SuperSeal 2-pole plug/connector (male/female)
DC Power Supply	24VDC - See ordering information overleaf
Maximum System Input Power	700W single panel or 350W per panel (two panels in series)
Maximum System Input Voltage	150V single panel or 75V per panel (two panels in series)
Maximum System Input Current	12A
Maximum Isolation Voltage	1500V
Input Protection	Over voltage & transient voltage suppression
Maximum System Output Current	12A (99.5% efficiency)
Breakdown Voltage	1500VAC for 1 minute
Maximum System Output Voltage	150V single panel or 75V per panel (two panels in series)
Output Protection	Over voltage, over current & transient voltage suppression
Max. Input Short Circuit Current	15A
Operating Temperature	-30°C to +95°C
Ambient Operating Temperature	-30°C to +55°C
IP Class Protection	>IP68, NEMA 4X
PV Casing	Flame retardant Polycarbonate - UL94-V0
Limited Warranty	FRS-000 : 20 Years, FRS-ESWD(K) : 5 Years (See <a href="https://downloads.imopc.com/friraptor-limited-warranty.pdf">https://downloads.imopc.com/friraptor-limited-warranty.pdf</a> for terms)
Weight (without cables)	400g
Panel Cable Length	120mm
String & Signal Cable Length	1800mm
Standard Compliance	EN 61000, EN 61646, EN 61215, IEC 62716 draft C (NH, resistant), VDE-AR-E 2100-712, BS 7671-712, UL 1741
PV Connectors	Original Multi Contact MC4

### Dimensions mm (inches)



Emergency Shutdown Switches		Dimensions mm (inches) - Height x Width x Depth	
FRS-ESWD1/FRS-ESWD2-K	125mm x 125mm x 75mm	(4.92" x 4.92" x 2.95")	
FRS-ESWD2-24/FRS-ESWD2-24-K	125mm x 175mm x 75mm	(4.92" x 6.89" x 2.95")	
FRS-ESWD2-310/FRS-ESWD2-310-K	175mm x 250mm x 100mm	(6.89" x 9.84" x 3.93")	
FRS-ESWD2-610/FRS-ESWD2-610-K	175mm x 250mm x 100mm	(6.89" x 9.84" x 3.93")	
FRS-ESW1-1010	175mm x 250mm x 100mm	(6.89" x 9.84" x 3.93")	

Certified Bleed Boxes		Dimensions mm (inches) - Height x Width x Depth	
FRS-CBLD	175mm x 125mm x 125mm	(6.89" x 4.92" x 4.92")	
FRS-CBLD1 / Z*	175mm x 145mm x 125mm	(6.89" x 5.71" x 4.92")	

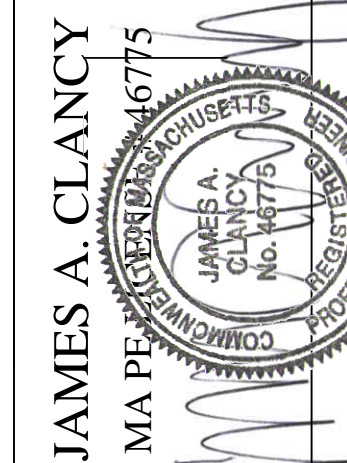
\*FRS-CBLD1 & FRS-CBLD2 with includes grounding bolt (adds 20mm to width)

Keeping Solar Safe

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PREPARED FOR:  
**NextGrid**  
PO BOX 7775 #73069  
SAN FRANCISCO, CA 94120

PROPOSED PHOTOVOLTAIC ARRAY  
225 BODWELL ST.  
225 BODWELL ST.  
AVON, MA 02322



### REVISIONS

DATE	COMMENT
05-04-20	INCREASE DC SIZE
05-12-20	INVERTER CHANGE / ESS
05-20-20	ADDITIONAL ACCESS
05-20-20	DC CONFIG EDITED
07-31-20	LAYOUT CHANGE
11-16-21	MOD/DC CONFIG CHANGE

JOB #	
DRWN	RCA
CHKD	JAC
SCALE	AS NOTED
DATE	03-19-2020

E-3.1

EQUIPMENT SPECIFICATIONS





## The SPOT: Alencon's PV String Level DC-DC Optimizer

**SPOT Applications:**  
DC-Coupled Solar + Storage  
PV Repowering  
Microgrids

### The Most Powerful and Flexible PV DC-DC Optimizer on the Market Today

Alencon's String Power Optimizer and Transmitter, the SPOT, is the solution to maximizing energy production from your PV plant. Alencon's SPOT is a complete energy harvesting system that can easily be retrofitted into any existing PV plant or deployed in a new PV system. Alencon's SPOT will allow you to generate more energy from a PV plant by offering more granular maximum power point tracking (MPPT).

The SPOT uses Galvanic Isolation to change voltage on the output relative to the input making it the ideal tool for DC coupling of Solar + Storage as well as Repowering aged PV systems. Additionally, Alencon's SPOT is a fantastic operations and maintenance (O&M) tool because it isolates faults to the string level, controls each string and provides up to the moment performance data on your PV array.

### Features

- Individual String Level Maximum Power Point Tracking (MPPT)
- Map PV voltage to any DC bus voltage range with Galvanic Isolation
- Easy to install
- Create complete isolation between the PV strings and the inverter
- String level monitoring of PV plant performance

### Benefits

- Increase energy yield
- Mitigate string level mismatch issues caused by uneven soiling, cloud cover, module degradation and/or sporadic damage
- Reduce conduction DC bus losses
- Improve the efficiency of your central inverter
- Quick installation
- Remote control over every string

### Advantages

- Unique Solution for DC Coupling of Solar + Storage
- Facilitate the Replacement of Failed Inverters
- More energy produced
- Works with new, transformerless string inverters
- Most flexible voltage mapping of any PV DC-DC optimizer on the market today
- Faster deployment means less installation costs
- Offers greater flexibility in interfacing to a PV plant's existing inverters
- Improved monitoring of your plant's energy production
- Easier O&M

### Technical Specifications

SPOT Model	SPOT 600	SPOT 1000	SPOT 1500
<b>Input</b>			
MPPTs per SPOT (Standard)		4	
String Operating Voltage <sup>1</sup>	200 - 600 V	300 - 1000 V	700 - 1500 V
MPPT Voltage Range <sup>1</sup>	250 - 500 V	540 - 820 V	850 - 1300 V
Maximum String Voltage	600 V	1000 V	1500 V
Maximum Current Per Input @ 25°C	19.2A	19.2A	14A
Maximum Current Per Input @ 50°C	15A	15A	10A
Reverse Polarity Protection	Yes		
Max. Input Power per Input @ 25°C	11.5 kW	19.2 kW	15.4 kW
Max. Input Power per Input @ 50°C	9 kW	12 kW	11 kW
Grounding Configuration	Positive, Negative or Ungrounded		
<b>Output</b>			
Output Operating Voltage <sup>1</sup>	Fully Configurable		
Number of Outputs	4		
Max. Current Per Output @ 25°C	19.2A	19.2A	14A
Max. Current Per Output @ 50°C	15A	15A	10A
Max. Power Rating Per Output @ 25°C	11.5 kW	19.2 kW	15.4 kW
Max. Power Rating Per Output @ 50°C	9 kW	12 kW	11 kW
Reverse Polarity Protection	Yes		
<b>Efficiency</b>			
Peak Efficiency	98.5%		
CEC Weighted Efficiency	98%		
<b>Standards &amp; Compliance</b>			
Certifications	UL1741, IEC 62109-1, CSA C22.2		
<b>Environmental</b>			
Storage Temperature	-40°C to 85°C		
Cooling	Natural Convection or Forced Air		
Environmental Rating	NEMA 4 & IP 66		
Humidity	0-95%		
Operating Ambient Temp.	-40°C to 50°C		
<b>Physical Characteristics</b>			
Size (HxWxD)	55 M x 42 M x 27 M		
Weight	32 - 51 KG (based on configuration)		
<b>Additional Features</b>			
MPPT Sampling Rate	Configurable Down to 19 Milliseconds		
Standard Communications	Wired via Modbus RTU		
Enhanced Communications - Requires ACE	Wired or Wireless - Modbus TCP Protocol		
Arc Fault Detection - Requires GARD	UL1699B, NEC 2017 Compliant		
Ground Fault Detection - Requires GARD	UL1741, NEC 2017 Compliant		
String Level Rapid Shutdown - Requires GARD	Manual or Remote via Communication with ACE		

<sup>1</sup>Configurable per deployment from this range depending on requirements.

The Alencon Advantage: Full Galvanic Isolation, PV-IoT™

Alencon's SPOT is your secret weapon for assuring maximum energy production from your PV plant. The SPOT employs a great deal of proprietary technology you can only get from Alencon to assure your PV plant is producing the most possible power while making O&M more efficient and less expensive than ever before. The Alencon SPOT is the only utility scale DC-DC optimizer that offers full galvanic isolation between each string and a central inverter.

The SPOT's galvanic isolation gives you an unparalleled level of protection from the harmful effects of faults in the PV array. Alencon's SPOT is a wireless, Internet of things (IoT) ready device, using Alencon's proprietary PV-IoT™ technology. Each SPOT in the field communicates wirelessly back to a central aggregator which allows you to monitor the performance of each string from anywhere in the world.



Alencon Systems is a proud member of these leading industry organizations

888-410-7915 info@alenconsystems.com  
www.alenconsystems.com



## PD250/AC-480 250 kW Energy Storage Inverter Reliable service in the most demanding applications

Engineered to provide years of reliable service in the most demanding applications.

EPC's advanced smart inverters for energy storage will enable you to deploy scalable power conversion systems with less effort and in less time. Integrating 1,000 V class battery energy storage systems has never been easier or more compact. With world-class power density and an easy to install design, your energy storage system will be up and running in no time.

This inverter is designed from the ground up with simplicity, reliability, and scalability in mind. The liquid-cooled inverter includes an integrated AC contactor, AC breaker, DC contactor, and precharge circuit, enabling simple installation.

The PD250/AC-480 provides reliable, abundant power in a small footprint for years of reliable service.



### Bidirectional Inverter

- THD <2%
- 1000 VDC
- Peak efficiency 98.4%
- 50 & 60 Hz operation
- Grid-tie and off-grid
- Parallel UPS backup
- Real and reactive power control
- Fully bidirectional
- Single-phase capable

## PD250/AC-480 Bidirectional Energy Storage & Microgrid PCS

<b>AC</b>	AC port configuration	IP2W or 2P2W   3P3W
	AC voltage range	480 VRMS +10% / -12%
	AC export power @ 60°C inlet	250 kVA   301 ARMS
	AC import power @ 55°C inlet	250 kVA   301 ARMS
	Overload capacity	110%, 10 minutes   125%, 10 seconds
	AC high voltage ride-through	1.2 pu
	Maximum grid impedance	8%, 500 kVA base
	Nominal frequency range	50 - 60 Hz (field settable)
	Harmonic distortion	UL1741/IEEE 1547, <3% TDDI per IEEE 519
	Power factor / reactive power	0 leading ... 0 lagging (full 4-quadrant operation)
	Maximum aux. power consumption	700 W (includes ext. cooling pump + fan)
	CEC efficiency	98.0%
	Peak DC to AC efficiency	98.4%
<b>DC</b>	DC voltage range	720 - 1000 VDC
	Maximum DC current	750 ADC
	Battery technology	all battery types, fuel cells, other DC sources, etc.
	Number of DC inputs	1
<b>Environmental</b>	Ambient temperature (operation)	-20°C to 50°C
	Ambient temperature (storage)	-20°C to 50°C
	Protection degree	IP00 (requires enclosure)
	Relative humidity	5% - 95% non-condensing
	Max elevation	2,000 m [6,500 ft.]
	Airborne noise	<75 dBA @ 1m
	Temperature de-rating	automatic; see charts
<b>Cabinet</b>	Maximum dimensions (H x W x D)	mm: [670 x 530 x 1045]   in: [26.4" x 20.9" x 41.1"]
	Weight	300 kg [662 lb.]
	Mounting	rack mount
	Cooling	liquid
	Cooling fluid	30% - 50% EWG or PWG
<b>Certifications</b>	Safety	UL 1741   C22.2 No. 107.1-16
	Utility Interconnect Source SRD	UL 1741-2010 R2.18 (SA)   IEEE 1547.1-2003 & 1547.1-2015   CA Rule 21 No. 16-06-052
<b>Protections</b>	AC protection	Breaker; 35, 50, 65, 100 kA Isc options
	DC protection	DC contactor & precharge; ext. fusing required
	Humidity	by customer
	Safety features	overvoltage, overcurrent, overtemperature
	Ground fault detection	not included
<b>Control</b>	Control interface	CAN, Modbus RS485, or Modbus TCP
	Command latency	1 ms
	Response time; e.g. step from full charge to discharge	20 ms; adjustable longer via parameters
	Black-start capable	Yes; requires external control power
	Grid-tied control modes	Voltage mode   PQ (power)   DG (current)   cos phi (pf)   STATCOM
	Grid-support functions	Volt/VAR   Hz/Watt   Volt/Watt   Fixed PF
	Islanded control modes	V&f
	Control power options	208 - 240 VAC   DC: 24 VDC



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PREPARED FOR:

**NextGrid**

PO BOX 7775 #73069  
SAN FRANCISCO, CA 94120

PROPOSED PHOTOVOLTAIC ARRAY

225 BODWELL ST.  
225 BODWELL ST.  
AVON, MA 02322

JAMES A. CLANCY  
MA PE 06775



### REVISIONS

DATE	COMMENT
05-04-20	INCREASE DC SIZE
05-12-20	INVERTER CHANGE / ESS
05-20-20	ADDITIONAL ACCESS
05-20-20	DC CONFIG EDITED
07-31-20	LAYOUT CHANGE
11-16-21	MOD/DC CONFIG CHANGE

JOB #	
DRWN	RCA
CHKD	JAC
SCALE	AS NOTED
DATE	03-19-2020

E-3.2

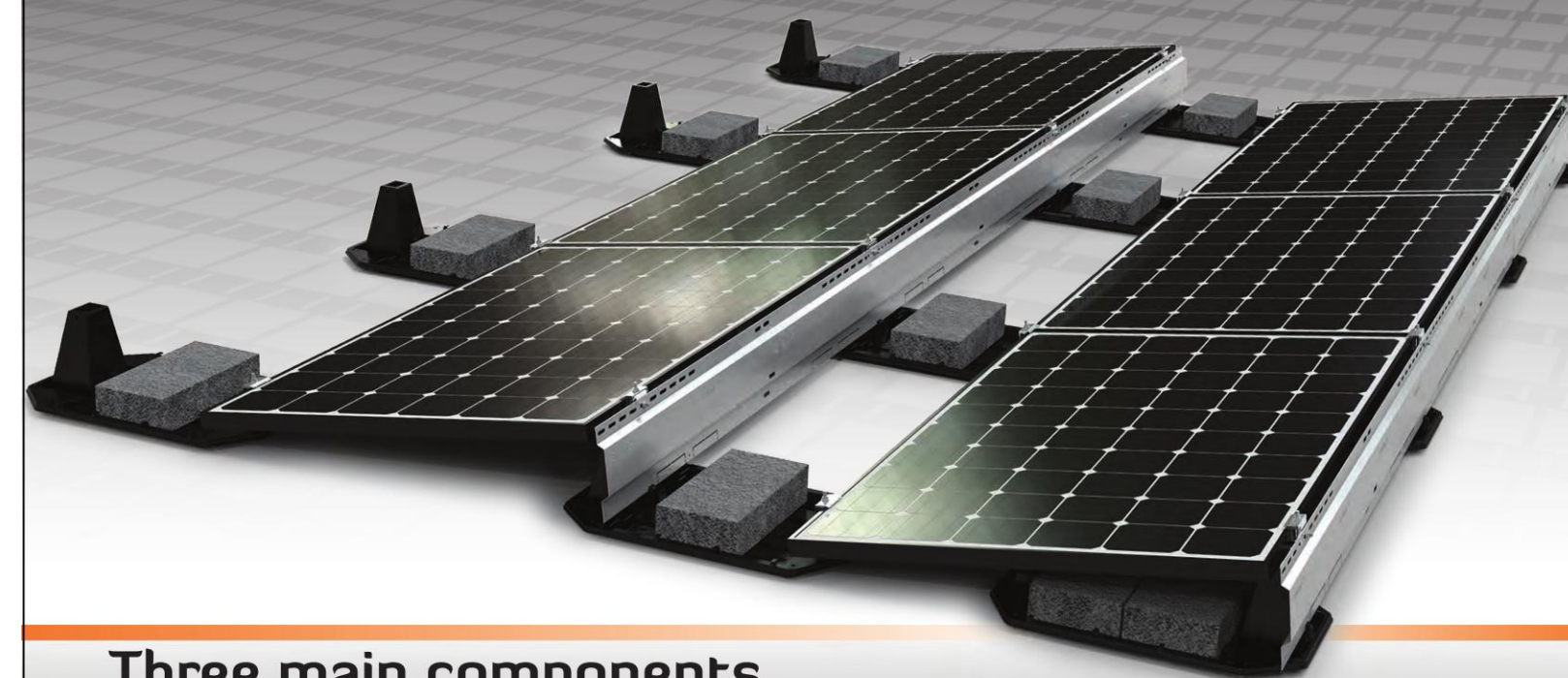
EQUIPMENT SPECIFICATIONS



# EcoFoot2+™

## Back in Black

PV installation Professionals use EcoFoot2+ to complete their projects in record time. The refreshed EcoFoot2+ design is now available in Black, along with a comprehensive UL2703 certification.



### Three main components



**Base**  
Our new UL-Listed ASA based resin is a durable material commonly used in automotive and construction applications. The material is class A fire rated as part of our UL2703 Certification.



**Preassembled Universal Clamp**  
The new preassembled universal clamp achieves integrated grounding without the use of grounding washers. UL2703



**Wind Deflector**  
The corrosion-resistant wind deflector on every module helps minimize uplift and reduce ballast requirements.

244 W. State Street, Athens OH 45701 | 740-249-1877 | www.ecolibriumsolar.com

## EcoFoot2 + Installer Feedback = EcoFoot2+™

Our design enhancements help you master the most challenging site and rooftop conditions



### System Benefits

- Low part count
- Rapid system deployment
- Preassembled Universal Clamp
- Increased design flexibility
- More ballast capacity
- Simplified logistics (up to 50kW per pallet)

### Validation Summary

- Certified to UL2703 Fire Class A for Type I and II modules
- Certified to UL2703 Grounding and Bonding
- Wind tunnel tested to 150mph
- SEAOC seismic compliant
- CFD and structurally tested DNV GL rated at 13.5 panels per installer-hour

### Technical Specifications

Dimensions: 26.5"L x 18.25"H

Typical System Weight: 3.5–6 lbs. per sq. ft.

Module orientation: Landscape/Portrait

Tilt angle: Landscape 10°/Portrait 5°

Module inter-row spacing: 18.9"

Roof pitch: 0° to 7°

Ballast requirements: 4" x 8" x 16"

Warranty: 25 years

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### ADDENDUM C Grounding & Bonding

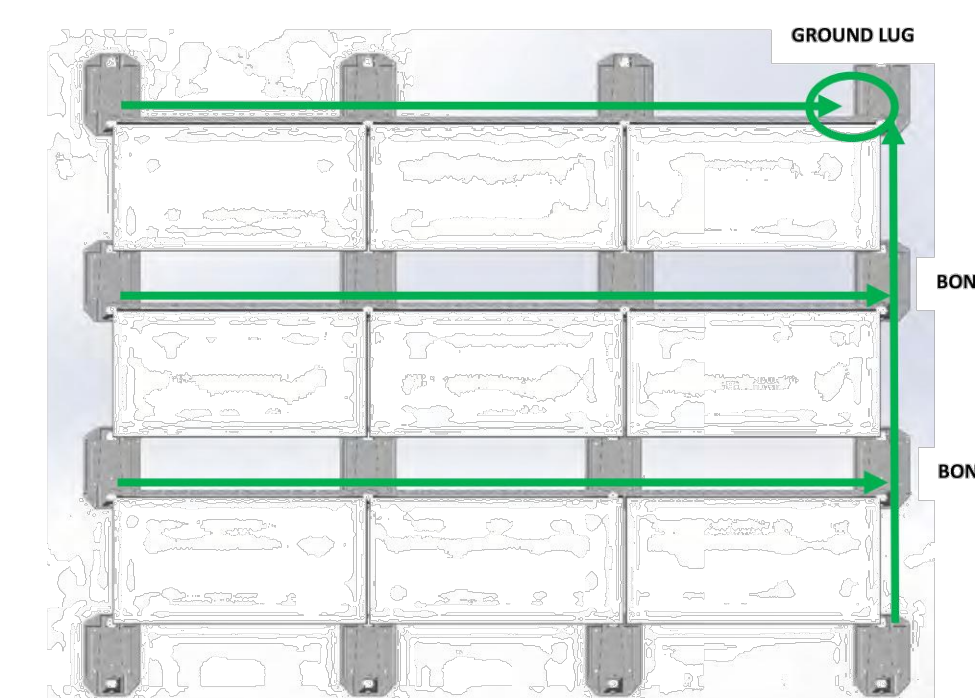
The EcoFoot2+ system has been tested by TÜV Rheinland and conforms to UL 2703 for Grounding and Bonding when installed per the published installation instructions.

EcoFoot2+ carries module-to-module ground bond through the Wind Deflector, Item E listed in the "EcoFoot2+ Core Components" table in this document.

Each row of modules/wind deflectors in an array of up to 400 modules must be grounded per the NEC and ANSI/NFPA 70 either through the designated ground hole in the Wind Deflector, or by drilling a ¼" ground hole into the Wind Deflector a minimum of ¼" from any edge. One Ground Lug is required for every 400 modules connected within an array.

Ecolibrium Solar recommends using #6 copper ground wire in conjunction with WEEB grounding devices such as the WEEB-LUG-6.7 or WEEB DSK516. Lugs are a single use component.

Other grounding methods must be reviewed and approved by a licensed master electrician or electrical engineer and Authority Having Jurisdiction (AHJ).



Green lines represent ground bond path. Wind Deflectors carry module-to-module east/west ground bond. Bonding jumpers carry row-to-row north/south ground bond.

EcoFoot2Plus\_Install\_Guide\_V1.7-FINAL  
January 27, 2020, ES10560

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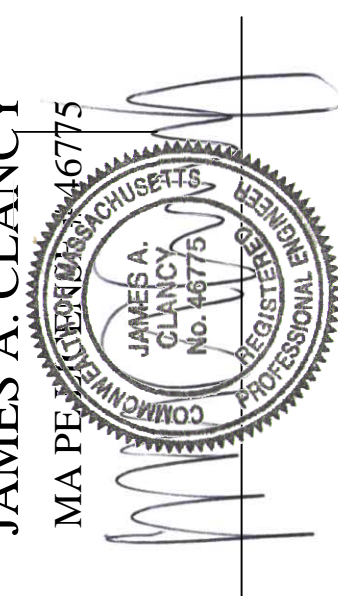
**NextGrid**

PO BOX 7775 #73069  
SAN FRANCISCO, CA 94120

PROPOSED PHOTOVOLTAIC ARRAY

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MA PE. 06775



### REVISIONS

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11-16-21	MOD/DC CONFIG CHANGE

JOB #	
DRWN	RCA
CHKD	JAC
SCALE	AS NOTED
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E-3.3

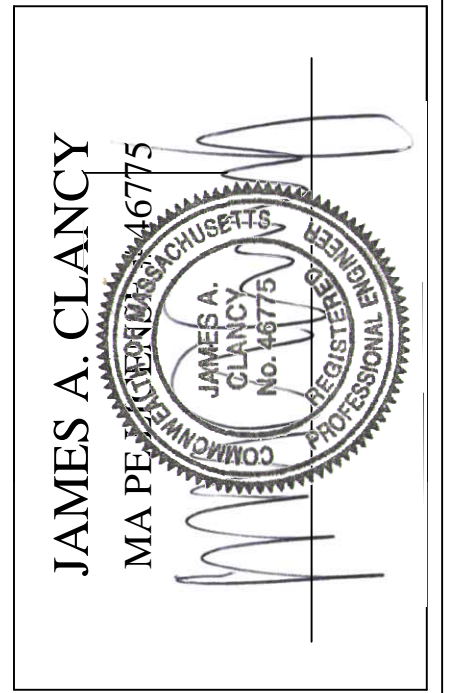
EQUIPMENT SPECIFICATIONS



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JOB #	
DRWN	RCA
CHKD	JAC
SCALE	AS NOTED
DATE	03-19-2020

**E-4**

**Procedural Notes**

- Prior to commencement of any work, the contractor shall notify owner, owner's representative and Architect/Engineer of any discrepancies noted among site conditions, manufacturer recommendations or codes, regulations or rules of jurisdictions having authority.
- All dimensions of existing conditions must be verified prior to commencing work.
- The contractor is responsible for all bracing and shoring of equipment during installation.
- Contractor shall be responsible for all safety precautions and measures on site. The Architect/Engineer has no overall supervisory authority and no direct responsibility for the specific working conditions.
- Contractor initiated changes shall be submitted in writing to the Architect/Engineer for approval prior to making any changes. Approved changes shall require a drawing revision to maintain control over the Architect/Engineer approved design. Deviation from these plans prior to Architect/Engineer approval places the contractor at risk.

**General Notes**

- The electrical contractor is responsible for installing all equipment and following all directions and instructions shown herein.
- The electrical contractor is advised that all drawings, component manuals, especially the inverter manuals, are to be read and understood prior to installation. The contractor is also advised to have all component switches in the off position and fuses removed prior to installation of fuse-bearing components and lock-out all disconnects.
- For safety it is recommended the installation crew always have a minimum of two people working together.
- This solar photovoltaic system is to be installed following the conventions of the National Electric Code as accepted/amended by the local AHJ. Any local code which may supersede the NEC shall govern.
- All electrical components to be installed with this system are to be "UL" listed or accepted equivalent. Equipment shall be NEMA 3R outdoor rated or better, unless located indoors.
- The contractor is responsible for selecting and purchasing equipment that will last the lifetime of the PV system (20 years min.). All enclosures, conduit straps, painted metal surfaces, concrete, grounding equipment and other products shall be selected to last the lifetime of the PV system. The Architect/Engineer specifies the minimum required equipment and specifications to accomplish the project and the electrical contractor is responsible to ensure that these specifications are met or exceeded with good quality equipment, workmanship and skill.
- DC voltage from the array is always present at the DC disconnect enclosure and the DC terminals of the inverter during daylight hours. All persons working or involved with this photovoltaic system are warned that the solar modules are energized whenever they are exposed to daylight.
- All portions of this solar electric system shall be clearly marked in accordance with the latest electrical code in effect for the project site.
- For proper maintenance and isolation of inverters, refer to isolation procedure in inverter operation manual.
- This photovoltaic system's utility interconnection point shall meet the specific requirements of Articles 690 and 705 of the National Electrical Code and the requirements of the local electrical utility of authority in this jurisdiction.
- The grounding of the photovoltaic system shall comply with Article 690 of the National Electrical Code.
- The electrical contractor is not to start or energize the PV or inverter system at any time until approved by the owner and governing electric utility.
- The contractor is responsible for mounting all equipment per the manufacturer's specifications. If specifications are not apparent, the contractor shall use diligent efforts to mount equipment such that it will be clean, level and solid in order to last the lifetime of this solar electric system.
- Any metal shavings resulting from site work shall be cleaned from enclosure interiors, top surfaces of enclosures. The ground surface and any additional areas where oxidized or conductive metal shavings may cause rust, electrical short circuits or other damage.
- The electrical contractor shall consider the weathering of equipment over time and eliminate the possibility of degradation of equipment due to water entry and UV exposure. As a result, we require the use of unistrut or similar mounting systems to mount enclosures, pull boxes, load centers, fuse boxes or other equipment to rooftops and walls to prevent water build-up may occur. Weep holes shall be provided in enclosures where condensation or water build-up may occur. Sealing conduit with a fire retardant foam or caulk at enclosure entry points is recommended to minimize condensation and pests in enclosures.
- The contractor will provide submittals (including drawings, catalog cuts, and manufacturer's data, etc.) for all equipment and materials. Submittals will be reviewed and returned. The contractor will be at risk for any work related to un-approved submittals.

**Electrical Notes**

- In every pull box, terminal box, and at all places where wires may not be readily identified by nameplate markings on the equipment to which they connect, identify each circuit with a plastic label or tag.
- The layout of conduit shown in these plans is indicative only. Contractor shall route and locate the conduits to suit site conditions. Contractor will submit for approval all changes in wiring and conduit with the Architect/Engineer which exceeds noted length of run.
- Where wire and cable routing is not shown, and destination only is indicated. Contractor shall determine exact routing and lengths required. A shop drawing of proposed installation shall be supplied to owner and owner's representative prior to installation and include proposed length of run.
- Underground conduit shall be UV resistant outdoor rated PVC Schedule 40. Conduit types are only recommended on the electrical diagrams. It is the responsibility of the electrical contractor to conform to these requirements.
- All metallic connectors and fittings shall be non-corroding, such as aluminum, stainless steel or galvanized.
- Bends shall not damage the raceway or significantly change the internal diameter of raceways (no kinks).
- Support conductors in vertical conduits in accordance with NEC requirements.
- Install all wiring materials in a neat workmanlike manner. Use good trade practices as required by chapter 3 of the NEC.
- Arrange conduit to maintain headroom and in a neat inconspicuous manner. Run parallel and at right angles to structural members. Provide boxes, fittings and bends for change in direction. Fasten conduit securely in place.
- Support conduit using steel or malleable iron straps, lay-in adjustable hangers, clevis hangers and split-hangers. Hanger spacing shall be 10' maximum. Use approved beam clamps for connection to structural members.
- Provide pull and junction boxes where required to facilitate the installation of wiring in addition to those shown on the drawings. Bends in conduits between pull boxes shall not exceed the equivalent of four 90 degree bends.
- When field cutting is required, the conduit shall be cut square and deburred.
- Conduit sizes not specified should conform to NEC specifications. Minimum conduit size 1" unless noted otherwise.
- The wiring minimum size should be # 12 AWG. Conductor material shall be copper unless otherwise noted. Conductor type shall be solid for # 12 and stranded for # 10 and larger.
- Safety regulations (lock out-tag out, etc.) must be observed by the contractor during construction.
- The wiring size is based on the estimated conduit routing as shown in this drawing package. Should the conduit's length increase due to relocation of source and/or routing, the conduit and wire may need to be resized. Please contact the Architect/Engineer prior to making any field changes.
- All copper wiring shall be XHHW or XHHW-2 for 90 C applications, DC Wire shall be 1000V rated PV wire for 1000V rated. All aluminum wiring shall be XHHW for 90 C applications and have compression lugs at terminations. Use bare copper for ground where applicable.
- Inverter interconnection via a bus tap is only legal when an over current protection (fusible AC disconnect) is located within 10 feet of the tapped conductors. Per NEC Article 240, the conductors shall be crimped with a single hole crimp-on lug, manufactured by ILSCO or BURNDY. Lugs shall be constructed of pure copper and tin plated for high conductivity. The lugs must be rated for 600 Volt DC applications minimum. The crimp must be made with the manufacturer's approved device to achieve the proper crimp connection. Use stainless steel or other non-corrosive hardware with the fastener torque to manufacturer's recommendations on all three phases. This torque level is a requirement. Minimum bend radius shall be observed to maintain good conductor quality and wire management in the load center or transformer. If this bend radius is too constricting, use a 90 crimp offered by ISLCO or BURNDY. Ensure that acceptable clearances for safe continuous operation are allotted with bus tap.

- Conductor and conduit sizing calculated on continuous duty and MAX 2% voltage drop where possible.
- All conduits shall be free of any obstructions before wire is pulled.
- Electrical contractor to provide signage as shown on these drawings and per NEC Article 690.
- Unless otherwise indicated, ground all exposed noncurrent-carrying metallic parts of electrical equipment, raceway systems, equipment structures and the neutral of all wiring systems in accordance with the NEC, State, and other applicable laws and regulations.
- Where ground rods are indicated or used, they shall be copper clad, not less than 3/4" in diameter, and 8 feet long and driven full length into the earth. Make ground connections by brazing, exothermic welding, or with approved pressure terminals or mechanical grounding devices, except inaccessible connections shall be made by exothermic welding. The point of contact of each exothermic weld shall be wire brushed or filed to a bare metal surface. Thermite welding cartridges and molds shall be used in accordance with the manufacturer's recommendations. After the welds have been made and cooled, slag shall be brushed from the welded area and the joint thoroughly cleaned.
- Trenches shall not be left unattended unless the area is fenced or barricaded to restrict entry to the area. Call the underground service firm before trenching. Warning tape shall be laid in trenches at a depth of 12 inches below finished grade and at least 12 inches above installed conduit, it shall be laid on the compacted backfill for the full length of the trench. Do not stretch the tape; installation of warning tape under slabs is not required. Conduit trenches shall be free of rocks, debris, etc. The trench shall be inspected by owner/Engineer or representative thereof prior to conduit installation.
- Mini power centers (when included) shall consist of a combination dry type transformer with primary breaker, a secondary breaker, and a panel board. Breakers shall be plug-on type. Transformer shall have 115 degree C rise insulation. The complete unit shall be UL labeled and be suitable for outdoor use. Provide Square D mini power-zone, Cutler-Hammer mini-power centers, or equal.
- Receptacles shall be duplex and rated 20 Amps at 120 VAC, 2 Pole, 3 Wire, NEMA type 5-20R and specification grade. All receptacles shall be GFI and weatherproof type. Device cover plates shall be suitable for the environment in which they are installed and the type of service they are used for.
- Heavy duty rated switches fused or non-fusible as indicated on the drawings, shall be provided as required. General duty switches will not be allowed. Switches shall have "quick-break" actuating mechanisms and shall be enclosed as required by the conditions of installation. The cover shall be interlocked with the switch such that the enclosure cannot be opened with the switch in the "on" position. The "on" and "off" positions shall be clearly marked by the manufacturer. The switch shall be capable of being locked in the open position. Provide enclosures suitable for the specific type of location in which they are installed. Provide visible blade switches were required by code or utility. Disconnect switches shall be manufactured by Cutler-Hammer, Square D or equal.
- Provide detectable underground warning tape at all feeders on primary of GSU transformer.
- E.C. to provide red-lined as-builts at the completion of the project. A red lined set shall be maintained and accessible on site throughout construction.
- Contractor shall be required to review conduit and wiring routing to prevent moisture from entering combiner boxes. Provide submittals to owner and owner's representative for approval, of all wiring, combiner boxes, conduit and other major BOS components.
- All exposed conduit shall be installed to accommodate expansion and contraction due to ambient temperature changes per NEC requirements.

**Module Mount Racking**

- Racking will consist of the specified manufacture as noted in layout & details.
- Provide tilt angle per the project drawings.
- Provide rack manufacturer's ballast and anchorage calculations and shop drawings to Architect / Engineer for review and project confirmation prior to installation. (When applicable)
- Verify rack mounting rail spacing with module manufacturer's support requirements. Report any discrepancy immediately to Architect / Engineer for clarification prior to installation of any PV modules.

**Inverter Installation Notes**

- Inverters shall be installed and wired per the manufacturer's installation manual.
- Verify inverter output voltage rating equals the utility line voltage at the point of connection.

**Monitoring and Data Acquisition**

- Monitoring system shall include data logger, weather station, revenue meter and sensors as shown in these drawings.
- Monitoring system components shall be installed per manufacturer's instructions.
- Wiring from components to equipment and to control panels must be continuous with no splices.

**Solar Array Commissioning**

- Before closing disconnects or attempting to energize the inverters, the following commissioning procedure shall be completed:
  - Contractor to follow system owner approved commissioning procedure per PV Technical Specification.

**String Combiner Boxes**

- Box shall have individual fuses for each string.
- Provide NEMA 3R enclosure. (Minimum)

**Array Combiner Boxes (When required)**

- Provide multiple input combiner box with individual fuses per single line diagram.
- Provide MIN. NEMA 3R enclosure.
- Provide remote monitoring. (when specified)

GENERAL NOTES