

PHOTOVOLTAIC ROOF MOUNT SYSTEM

CODE AND STANDARDS

THE INSTALLATION OF SOLAR ARRAYS AND PHOTOVOLTAIC POWER SYSTEMS SHALL COMPLY WITH THE FOLLOWING CODES:

- 2020 NATIONAL ELECTRICAL CODE
- 2018 NORTH CAROLINA RESIDENTIAL CODE
- 2018 NORTH CAROLINA BUILDING CODE
- ALL OTHER ORDINANCE ADOPTED BY THE LOCAL GOVERNING AGENCIES

SITE NOTES / OSHA REGULATION

1. A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
2. THE SOLAR PV INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
3. ROOFTOP MOUNTED PHOTOVOLTAIC PANELS AND MODULES SHALL BE TESTED, LISTED AND IDENTIFIED BY RECOGNIZED ELECTRICAL TESTING LABORATORY.
4. MODULES AND SUPPORT STRUCTURES SHALL BE GROUNDED
5. SOLAR INVERTER SHALL BE LISTED TO UL1741
6. ALL CONDUCTORS SHALL BE COPPER AND SHOULD BE 75 AND 90 DEG RATED
7. REMOVAL OF AN INTERACTIVE INVERTER OR OTHER EQUIPMENT SHALL NOT DISCONNECT THE BONDING CONNECTION BETWEEN THE GROUNDING ELECTRODE CONDUCTOR, THE PHOTOVOLTAIC SOURCE AND OUTPUT CIRCUIT GROUNDED CONDUCTORS.
8. LIVE PARTS OF PV SOURCE CIRCUITS AND PV OUTPUT CIRCUITS OVER 150V TO GROUND SHALL NOT BE ACCESSIBLE TO OTHER THAN QUALIFIED PERSONS WHILE ENERGIZED.
9. ALL PV MODULES AND ASSOCIATED EQUIPMENT AND WIRING SHALL BE PROTECTED FROM PHYSICAL DAMAGE.

SOLAR CONTRACTOR

1. MODULE CERTIFICATIONS INCLUDE UL1703, IEC61646, IEC61370.
2. IF APPLICABLE, MODULE GROUNDING LUGS MUST BE INSTALLED AT THE MARKED GROUNDING LUG HOLES PER THE MANUFACTURERS INSTALLATION REQUIREMENTS.
3. AS INDICATED BY DESIGN, OTHER NRTL LISTED MODULE GROUNDING DEVICES MAY BE USED IN PLACE OF STANDARD GROUNDING LUGS AS SHOWN IN MANUFACTURER DOCUMENTATION AND APPROVED BY THE AHJ.
4. ALL MICROINVERTERS, PHOTOVOLTAIC MODULES, AC COMBINERS, DC-AC CONVERTERS AND SOURCE CIRCUIT COMBINERS INTENDED FOR USE IN A PHOTOVOLTAIC POWER SYSTEM WILL BE IDENTIFIED AND LISTED FOR THE APPLICATION PER NEC690.4(B).
5. ALL SIGNAGE TO BE INSTALLED IN ACCORDANCE WITH LOCAL BUILDING CODE.
6. TERMINALS AND LUGS WILL BE TIGHTENED TO MANUFACTURER TORQUE SPECIFICATIONS (WHEN PROVIDED) IN ACCORDANCE WITH NEC CODE 110.14(D) ON ALL ELECTRICAL CONNECTIONS.
7. MAX DC VOLTAGE CALCULATED USING MANUFACTURER PROVIDED TEMP COEFFICIENT FOR VOC UNLESS NOT AVAILABLE.

SR.#	PROJECT INFORMATION	
1	PV MODULES	30 x Q.TRON BLK M-G2+ 425W
2	INVERTER + BATTERY	01 X POWERWALL3
3	ROOF TYPE	ASPHALT SHINGLES
4	RACKING	PSR-B84 RAILS (BLACK)
5	MOUNTING TYPE	COMP MOUNT FLASHING (BLACK)
6	DC SIZE	12.75 KW
7	AC SIZE	11.5 KVA



5112 Departure Drive,
Raleigh NC 27616
O: 919.948.6474
E: info@8msolar.com

SR.#	PROJECT INFORMATION	
1	PV1	DRAWING INDEX
2	PV2	SITE LAYOUT
3	PV3	STRING MAPPING
4	PV4	ELECTRICAL ONE LINE DIAGRAM
5	PV5	DETAILED ELECTRICAL WIRING SCHEMATIC
6	PV6	PV LABELS
7	PV7	BILL OF MATERIALS
8	PV8	ATTACHMENT DETAILS

Customer Information:

Trevor Johnson

5657 Red Hill Church
Road Coats NC 27521

Customer Signature:

Sheet Name:

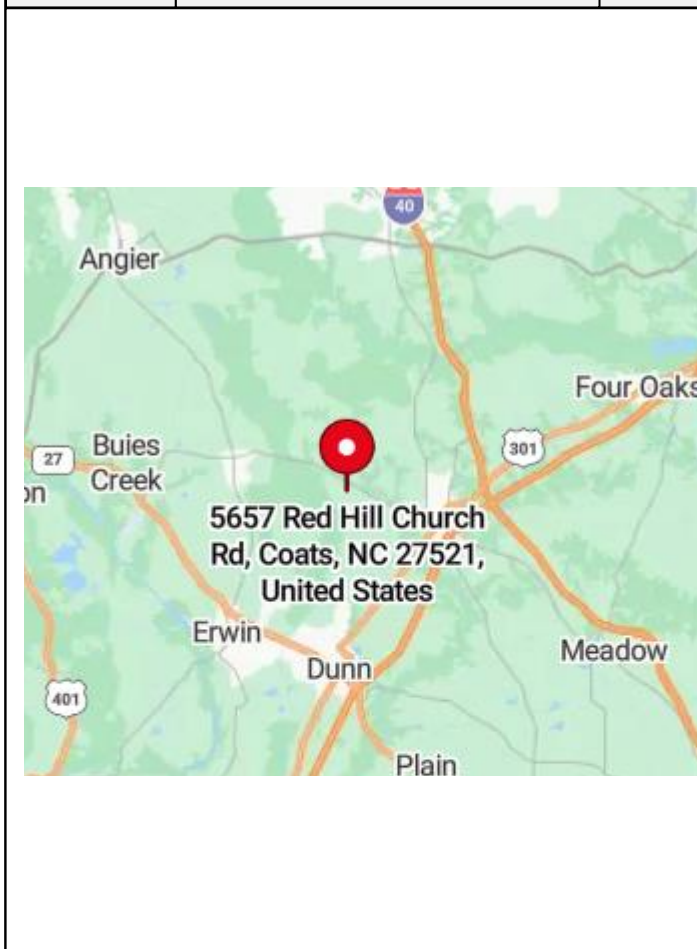
Drawing Index

JOB NUMBER:

24-365-LWTJ

Date:	Revision:
09/12/2024	A

Sheet Size:	Sheet Number:
ANSI C 17" X 22"	PV1



DESIGN CRITERIA

WIND SPEED: 120 MPH
GROUND SNOW LOAD: 15 PSF
WIND EXPOSURE FACTOR: B

UTILITY COMPANY:
DUKE ENERGY

PERMIT ISSUER (AHJ):
HARNETT COUNTY

SCOPE OF WORK


INSTALLATION OF UTILITY INTERACTIVE PHOTOVOLTAIC SOLAR SYSTEM.

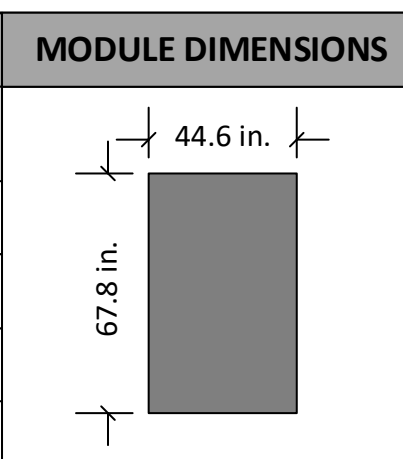
VICINITY MAP

TOP VIEW OF THE BUILDING

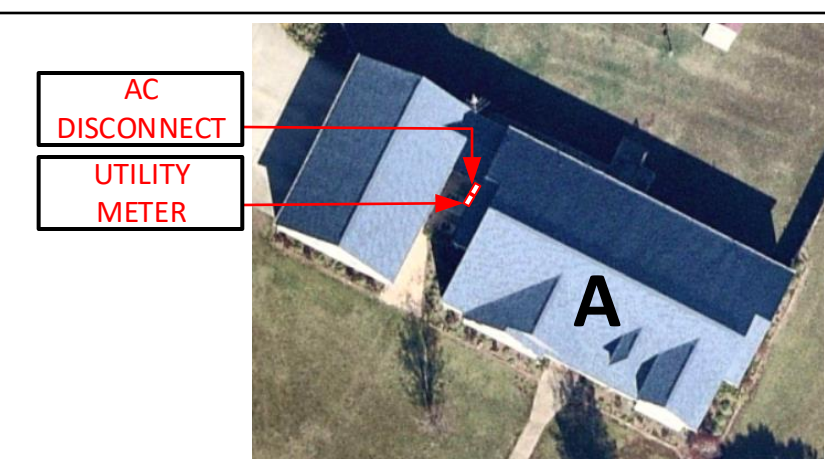


Ali Buttar
PVIP #031310-32

ROOF DESCRIPTION			
ROOF	PITCH	AZIMUTH	NO. OF MODULES
A	38°	207°	30
Vent		<ul style="list-style-type: none"> Roof A has no vent. No vents will be covered by PV modules during the installation 	



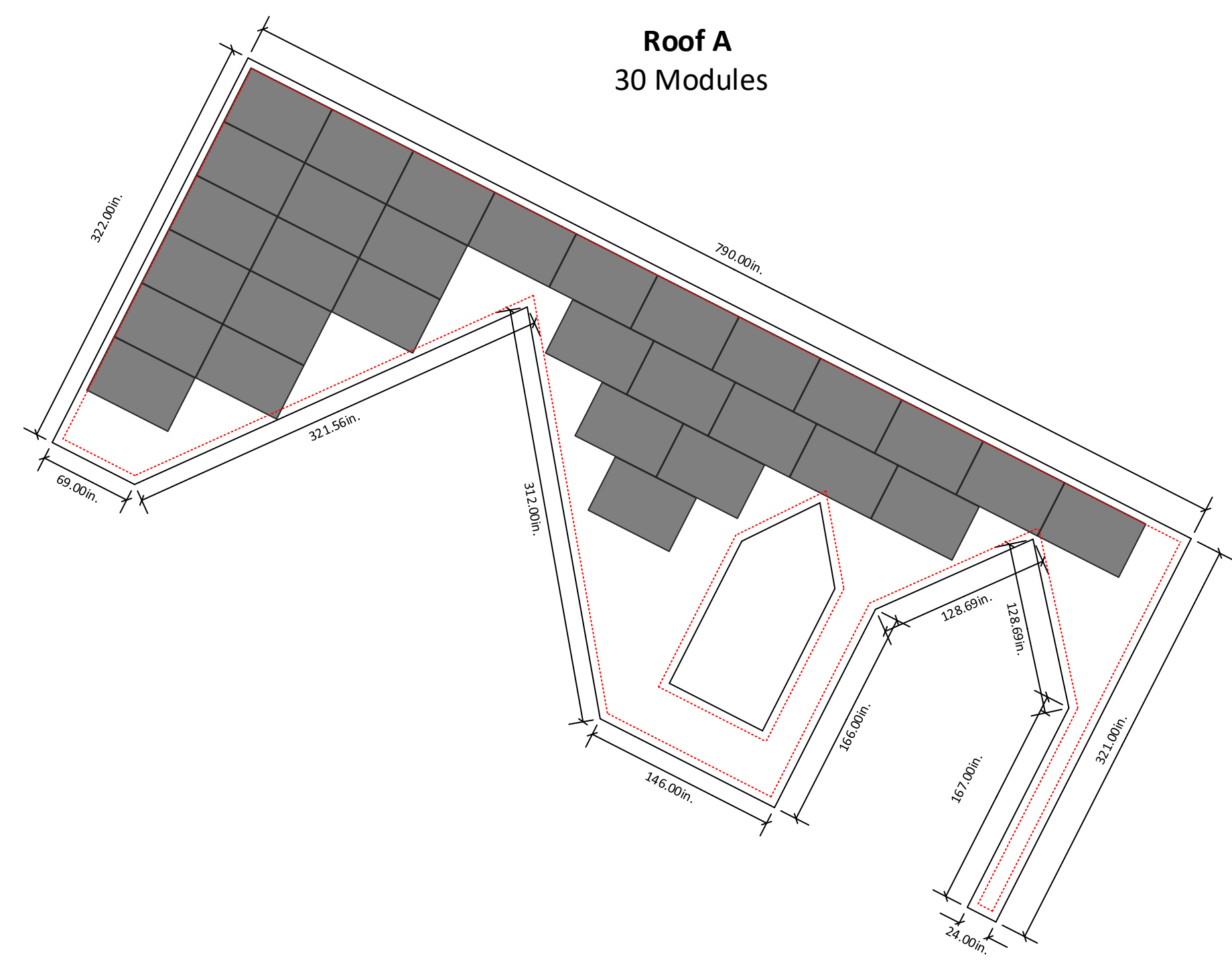
PV System Dead Load (Panel + Racking weight) / PV System Area (No. of panels x Weight of panel(lbs.) +Length of racking(ft.) x 1.15 lb.ft) / (No. of panels x Height x Width) = Total psf				
ROOF	A			
DEAD LOAD (PSF)	2.87			




5112 Departure Drive,
Raleigh NC 27616
O: 919.948.6474
E: info@8msolar.com

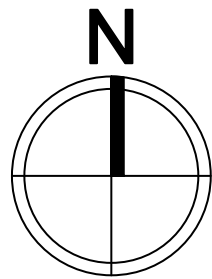
SYSTEM DETAILS

NUMBER OF PANELS : 30
 PANELS MODEL : Q.TRON BLK M-G2+ 425W
 DC SIZE : 12.75 KW
 AC SIZE : 11.5 KVA



6in setback from sides of the roof

SITE LAYOUT
SCALE: 1/8" - 1'



Customer Information:

Trevor Johnson

5657 Red Hill Church
Road Coats NC 27521

Customer Signature:

Sheet Name:

Site Layout

JOB NUMBER:

24-365-LWTJ

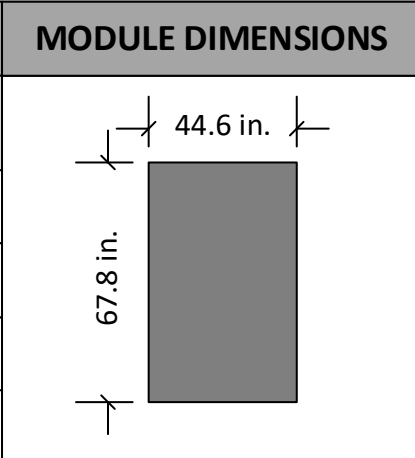
Date:	Revision:
09/12/2024	A

Sheet Size:	Sheet Number:
ANSI C 17" X 22"	PV2

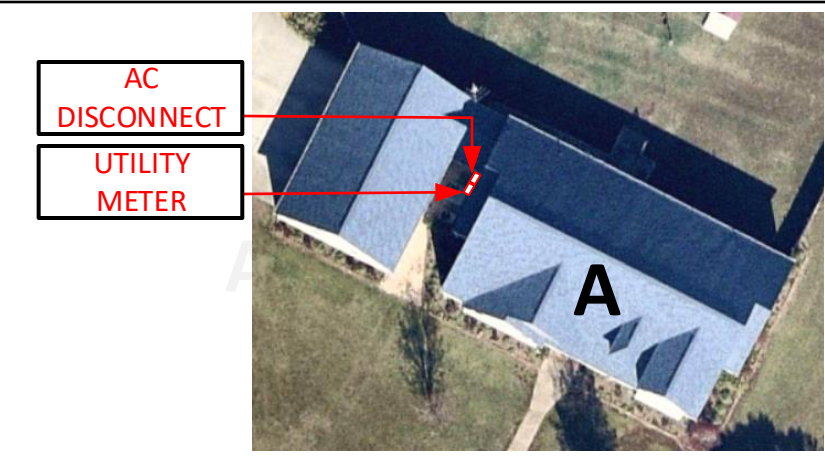


PV Installation Professional
Ali Buttar
PVIP #031310-32

ROOF DESCRIPTION			
ROOF	PITCH	AZIMUTH	NO. OF MODULES
A	38°	207°	30



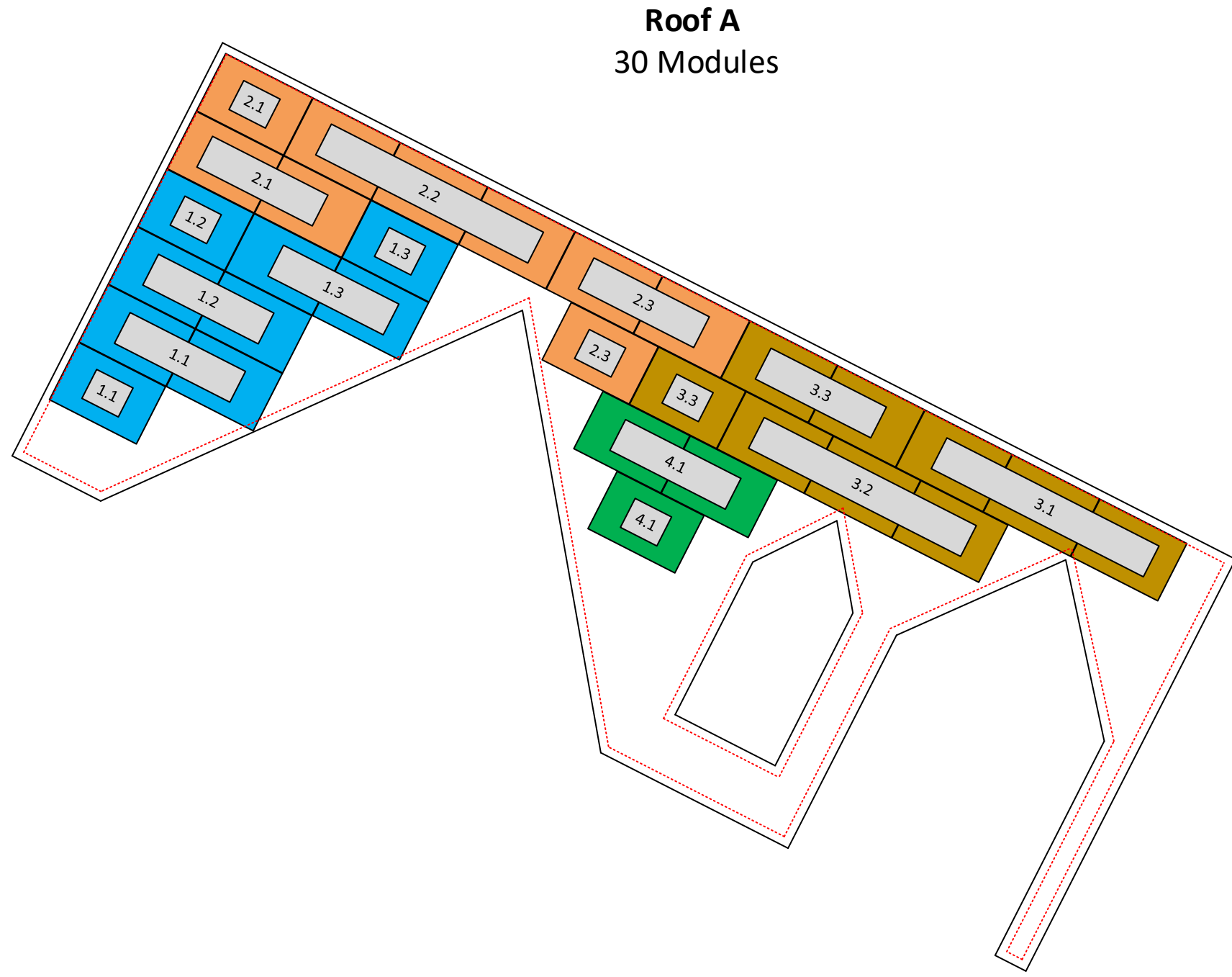
STRING LAYOUT					
TESLA POWERWALL3					
Strings #	No. of Modules	Color	Strings #	No. of Modules	Color
String 1	09	Blue	String 4	03	Green
String 2	09	Orange			Purple
String 3	09	Yellow			Light Blue



5112 Departure Drive,
Raleigh NC 27616
O: 919.948.6474
E: info@8msolar.com

SYSTEM DETAILS

NUMBER OF PANELS : 30
PANELS MODEL : Q.TRON BLK M-G2+ 425W
DC SIZE : 12.75 KW
AC SIZE : 11.5 KVA



Tesla MCI (Mid Circuit Interrupter)	<input type="checkbox"/>
-------------------------------------	--------------------------

Customer Information:

Trevor Johnson
5657 Red Hill Church
Road Coats NC 27521

Customer Signature:

Sheet Name:

String Mapping

JOB NUMBER:

24-365-LWTJ

Date:

09/12/2024

Revision:

A

Sheet Size:

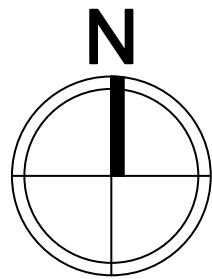
ANSI C
17" X 22"

Sheet Number:

PV3

6in setback from
sides of the roof

STRING MAPPING
SCALE: 1/8" - 1'



STRING CALCULATION

String #	No of Modules	Estimated Power	I _{max}	I _{mpp}	V _{oc}	V _{mpp}
1,2,3	09	3,825 W	20.24 Adc	12.98 Adc	351.27 Vdc	550 Vdc
4	03	1,275 W	20.24 Adc	12.98 Adc	117.09 Vdc	550 Vdc

NEC Code (2020) and UL Standard References

Rapid Shut Down	NEC 690.12 (A-D), UL1741	Grounding	NEC Article 250.30(A)
Disconnecting Means	NEC 690.13	Conduit Fill	NEC Table C.9, 310.15(B)(3)(a)
Feeder Sizing	NEC Table 310, 15(B)(16, 17)	Interconnection	NEC 705.12
Over current Protection	NEC 690.9		



5112 Departure Drive,
Raleigh NC 27616
O: 919.948.6474
E: info@8msolar.com

Customer Information:

Trevor Johnson

5657 Red Hill Church
Road Coats NC 27521

Customer Signature:

Sheet Name:

Electrical One Line Diagram

JOB NUMBER:

24-365-LWTJ

Date:

09/12/2024

Revision:

A

Sheet Size:

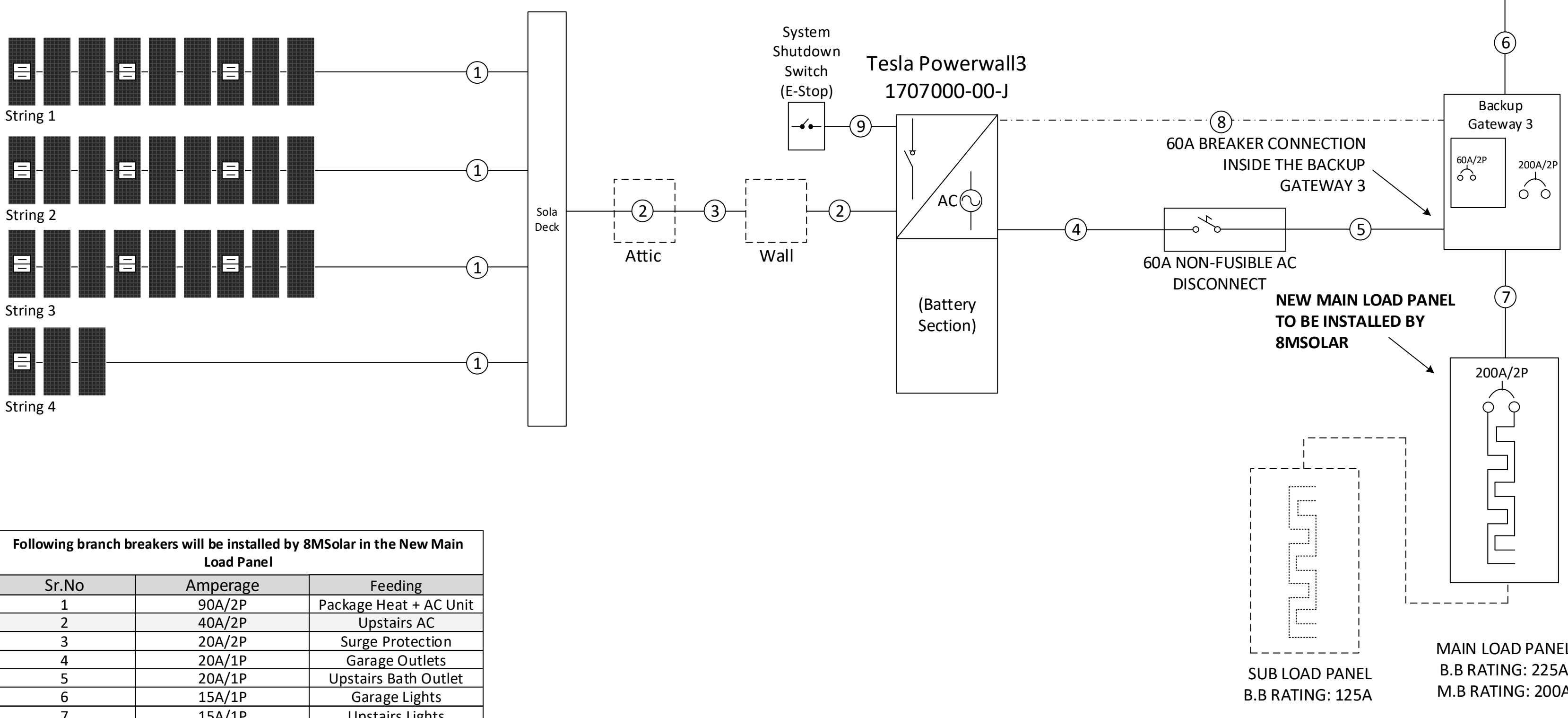
ANSI C
17" X 22"

Sheet Number:

PV4

30 X Q.TRON BLK M-G2+ 425W
425W
TESLA MCI-2 (Mid Circuit Interrupter)
RAPID SHUTDOWN EQUIPPED

Service Side Work: Power Drop Required



Following branch breakers will be installed by 8MSolar in the New Main Load Panel

Sr.No	Amperage	Feeding
1	90A/2P	Package Heat + AC Unit
2	40A/2P	Upstairs AC
3	20A/2P	Surge Protection
4	20A/1P	Garage Outlets
5	20A/1P	Upstairs Bath Outlet
6	15A/1P	Garage Lights
7	15A/1P	Upstairs Lights

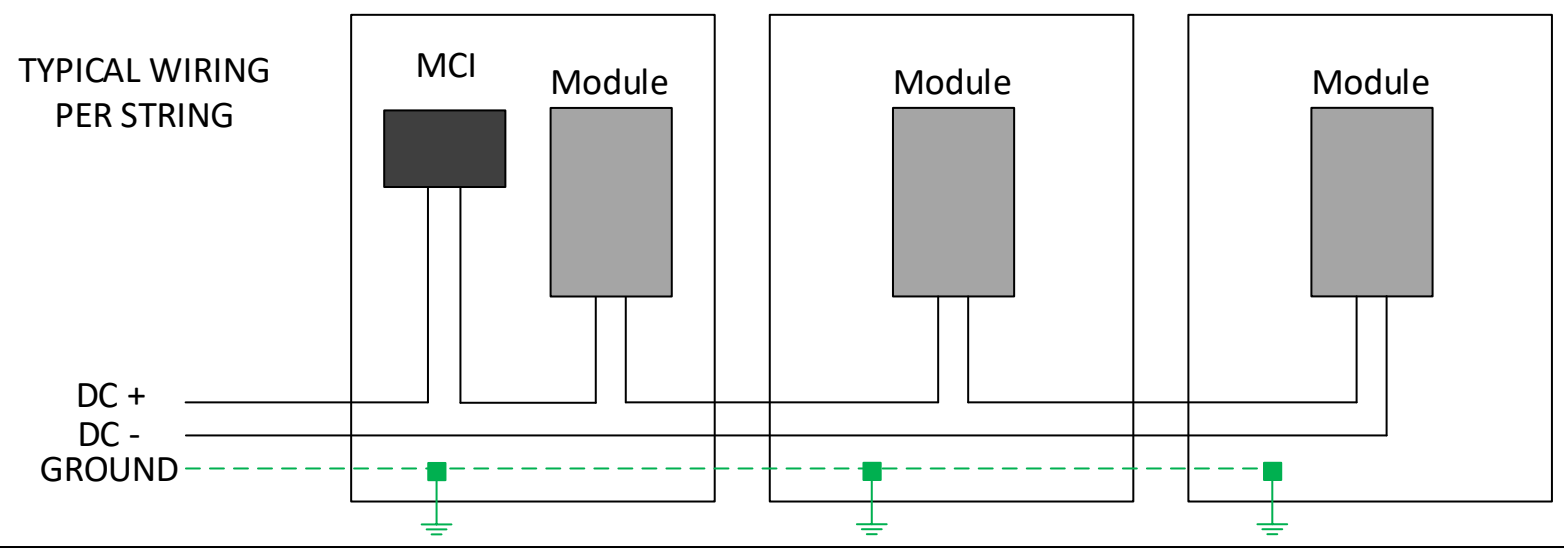
- Grounding will be done via Pegasus grounding lugs and mid-clamps to ensure the rail and panels are continuously grounded.
- Rapid Shutdown is included in the Mid Circuit Interrupter, refer to Mid Circuit Interrupter and Inverter attached datasheets.
- The load center/disconnect will be visible, lockable, accessible to utility linesmen, and properly labeled per NEC requirements. It will be located on the exterior wall next to the utility meter.
- Prepare cable in usual manner.
- Stretch tape and apply half-lapped to form void-free joint. Degree of stretch is not critical and may vary in different sections of joint to accomplish void-free application.
- Protect the joint with two half-lapped layers of any scotch vinyl plastic electrical tape.

Sr.No	#Wire	Conduit Size	Ground Wire	Amperage
1	2 x #10 PV		#10 Bare Cu	20.24
2	8 x #10 THHN Cu	3/4" LFMC	#10 Green Cu	20.24
3	8 x #10 THHN Cu	3/4" EMT	#10 Green Cu	20.24
4	3 x #6 THHN Cu	1" EMT	#6 Green Cu	60
5	3 x #6 THHN Cu	1" LFNC	#6 Green Cu	60
6	3 x #3/0 THHN Cu	2" PVC		200
7	3 x #3/0 THHN Cu	2" PVC	#6 Green Cu	200
8	4-conductor shielded (1 twisted pair) 16 AWG			
9	2-conductor shielded (1 twisted pair) 18 AWG	1/2" LFNC		

- System Size: 12,750W DC
- Battery Total Energy: 13.5 KWh
- (30) Q.TRON BLK M-G2+ 425W
- (10) 1879359-00-X: Tesla MCI-2
- (01) Tesla Powerwall3 (1707000-00-J)
- Inverter Output: 48A max @ 240 VAC (each)
- 11.5 kVA AC output max

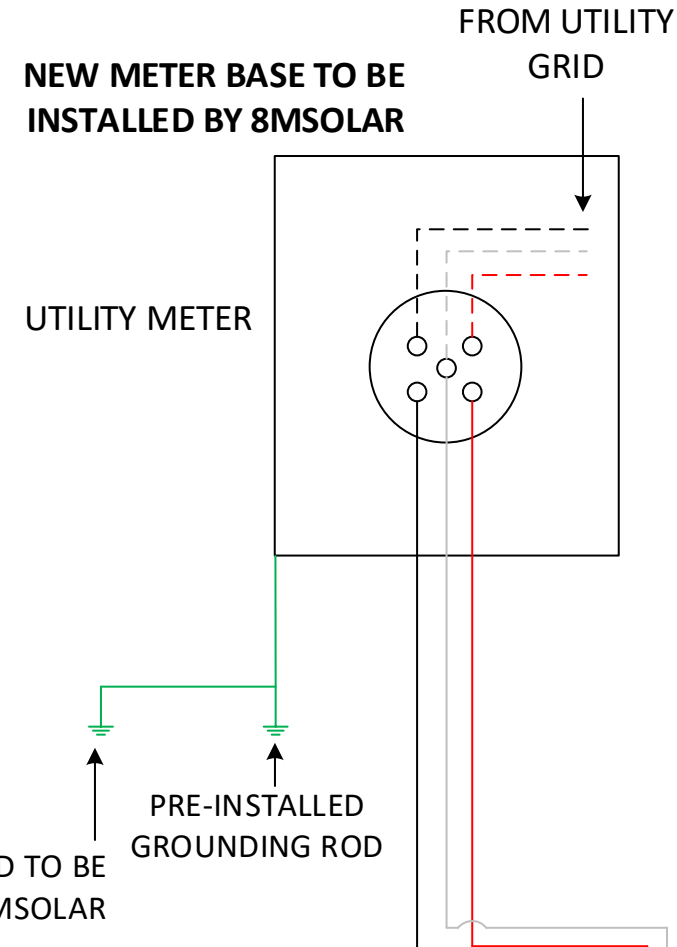


TYPICAL WIRING PER STRING



Line 1		Note: Tesla MCI should be at the start or end of every string and it should be after every three panels
Line 2		Note: Loads greater than 48A will not be backed by the battery and needs to be managed manually.
Neutral		Note: Accepted Breakers for Gateway: Eaton CSR or BW (100-200A)
Ground		

Note: Drain wire in the communication wire should be terminated at the Powerwall3 and it will not be terminated in the Backup Gateway3.
Note: Connect both grounding rods in a series connections with a bare copper keeping the minimum distance of 6ft between them.



5112 Departure Drive,
 Raleigh NC 27616
 O: 919.948.6474
 E: info@8msolar.com

Customer Information:

Trevor Johnson
 5657 Red Hill Church
 Road Coats NC 27521

Customer Signature:

Sheet Name:

Detailed Electrical Diagram

JOB NUMBER:

24-365-LWTJ

Date:

09/12/2024

Revision:

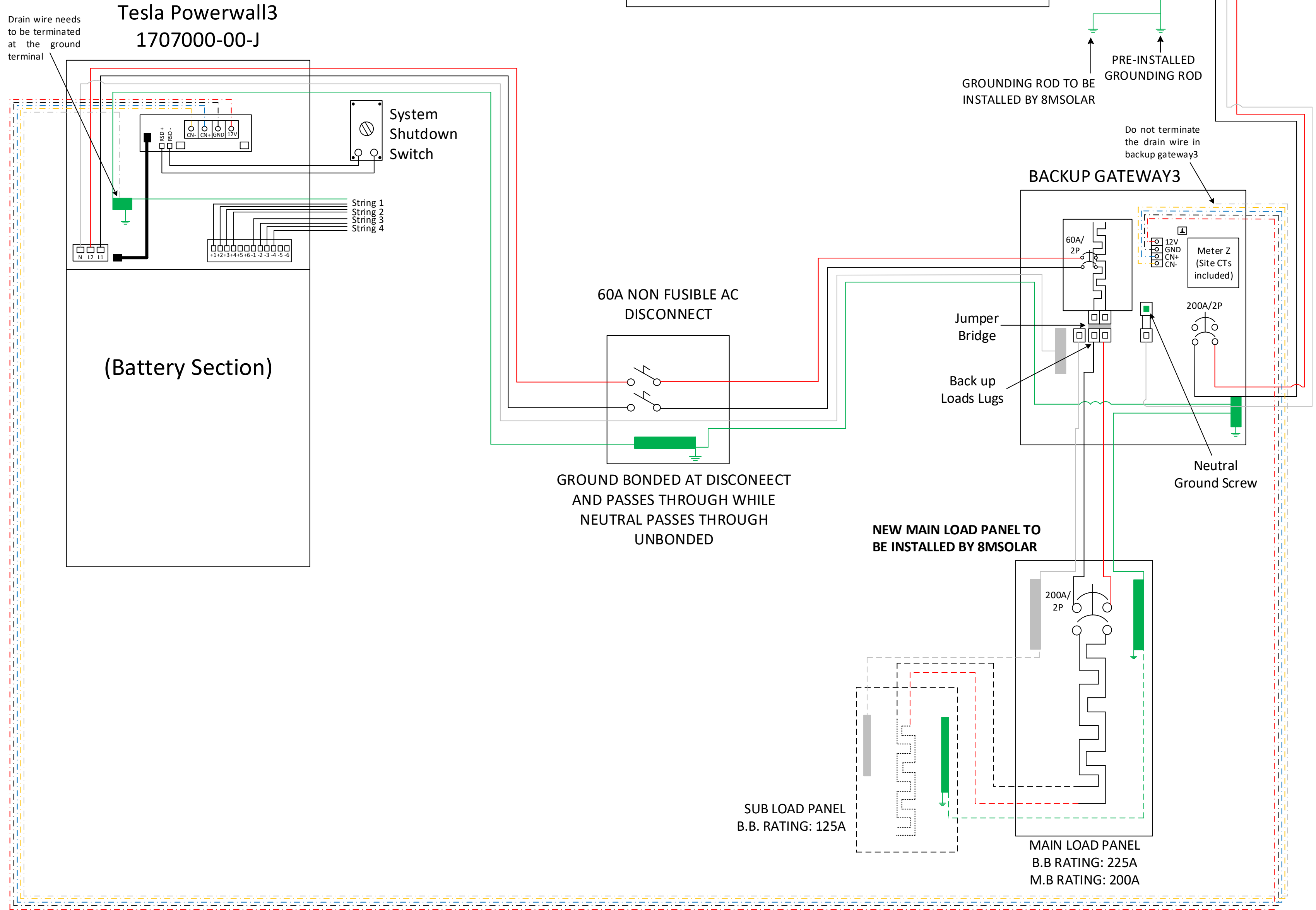
A

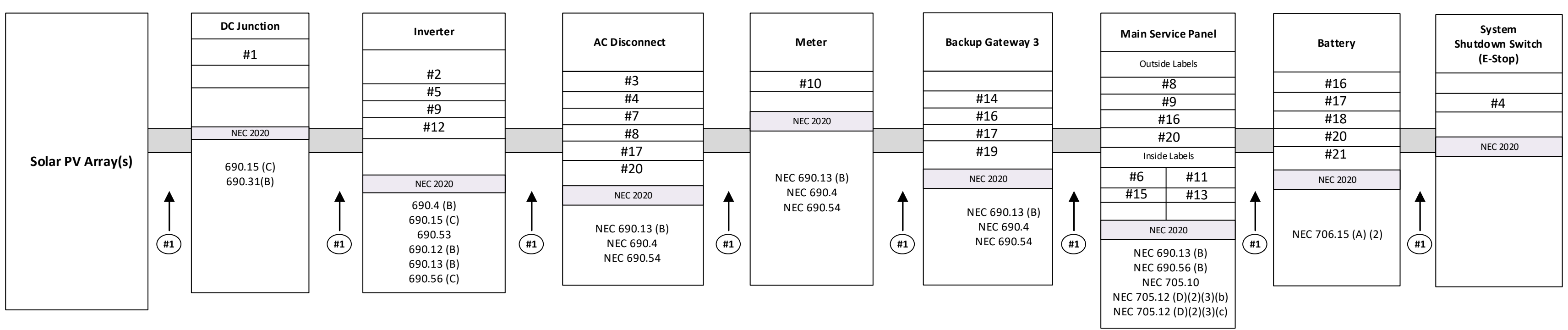
Sheet Size:

ANSI C
 17" X 22"

Sheet Number:

PV5





5112 Departure Drive,
Raleigh NC 27616
O: 919.948.6474
E: info@8msolar.com

Customer Information:

Trevor Johnson
5657 Red Hill Church
Road Coats NC 27521

Customer Signature:

Sheet Name:

PV Labels

JOB NUMBER:

24-365-LWTJ

Date:

09/12/2024

Revision:

A

Sheet Size:

ANSI C
17" X 22"

Sheet Number:

PV6



LABELING AND WARNING SIGNS: NEC 2020

A. PURPOSE
PROVIDE EMERGENCY RESPONDERS WITH APPROPRIATE WARNING AND GUIDANCE WITH RESPECT TO ISOLATING THE SOLAR ELECTRIC SYSTEM. THIS CAN FACILITATE IDENTIFYING ENERGIZED ELECTRICAL LINES THAT CONNECT THE SOLAR PANELS TO THE INVERTER, AS SHOULD NOT BE CUT WHEN VENTING FOR SMOKE REMOVAL.

B. MAIN SERVICE DISCONNECT:
1. RESIDENTIAL BUILDINGS- THE MARKING MAY BE PLACED WITHIN THE MAIN SERVICE DISCONNECT. THE MARKING SHALL BE PLACED ON THE OUTSIDE COVER IF THE MAIN SERVICE DISCONNECT IS OPERABLE WITH THE SERVICE PANEL CLOSED.

2. COMMERCIAL BUILDINGS- THE MARKINGS SHALL BE PLACED ADJACENT TO THE MAIN SERVICE DISCONNECT CLEARLY VISIBLE FROM THE LOCATION WHERE THE LEVER IS OPERATED

3. MARKINGS, VERBIAGE, FORMAT AND TYPE OF MATERIAL
a. VERBIAGE: CAUTION; SOLAR ELECTRIC SYSTEM CONNECTED
b. FORMAT:
(1) WHITE LETTERING ON A RED BACKGROUND
(2) MINIMUM 3/8 INCH LETTER HEIGHT
(3) ALL LETTERS SHALL BE CAPITALIZED
(4) ARIAL OR SIMILAR FONT, NON-BOLD

c. MATERIAL:
(1) REFLECTIVE, WEATHER RESISTANT MATERIAL SUITABLE FOR THE ENVIRONMENT (USE UL-969) AS STANDARD FOR WEATHER RATING); DURABLE ADHESIVE MATERIALS MEET THIS REQUIREMENT.

C. MARKING REQUIREMENTS ON DC CONDUIT, RACEWAYS, ENCLOSURES, CABLE ASSEMBLIES, DC COMBINERS AND JUNCTION BOXES;
1. MARKING: PLACEMENT, VERBIAGE, FORMAT AND TYPE OF MATERIAL.

a. PLACEMENT: MARKINGS SHALL BE PLACED EVERY 10 (TEN) FEET ON ALL INTERIOR AND EXTERIOR DC CONDUITS, RACEWAYS, ENCLOSURES AND CABLE ASSEMBLIES, AT TURNS ABOVE AND/OR BELOW PENETRATIONS, ALL DC COMBINERS AND JUNCTION

BOXES.
b. VERBIAGE: CAUTION SOLAR CIRCUIT
c. THE FORMAT AND TYPE OF MATERIAL SHALL ADHERE TO SECTION B-3.B & C ABOVE

D. INVERTERS ARE NOT REQUIRED TO HAVE CAUTION MARKINGS

#1 **WARNING: PHOTOVOLTAIC POWER SOURCE**

#2 **PHOTOVOLTAIC DC DISCONNECT**

#3 **PHOTOVOLTAIC AC DISCONNECT**

#4 **RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM**

#5 **MAXIMUM VOLTAGE 550Vdc**
MAX. RATED CIRCUIT CURRENT 12.98A dc
OF THE CHARGE CONTROLLER OR DC-TO-DC CONVERTER (IF INSTALLED)

#6 **PHOTOVOLTAIC POWER SOURCE**
OPERATING AC VOLTAGE 240 V
MAXIMUM OPERATING AC OUTPUT CURRENT 48 A

#7 **AC DISCONNECT PHOTOVOLTAIC SYSTEM POWER SOURCE**
RATED AC OUTPUT CURRENT 48 AMPS
NOMINAL OPERATING AC VOLTAGE 240 VOLTS

#8 **WARNING**
ELECTRIC SHOCK HAZARD
TERMINAL ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

#9 **WARNING**
DUAL POWER SUPPLY
SOURCES: UTILITY GRID AND PV SOLAR ELECTRIC SYSTEM

#10 **WARNING**
THREE POWER SOURCES
SOURCES: UTILITY GRID, BATTERY AND PV SOLAR ELECTRIC SYSTEM

#11 **WARNING**
TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL

#12 **WARNING**
BIPOLAR PHOTOVOLTAIC ARRAY DISCONNECT OF NEUTRAL GROUNDING CONDUCTORS MAY RESULT IN OVERVOLTAGE ON ARRAY OR INVERTER

#13 **WARNING**
POWER SOURCE OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE

#14 **WARNING**
SOLAR ELECTRIC CIRCUIT BREAKER IS BACKFEED

#15 **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

#16 **SOLAR AC DISCONNECT LOCATED AT NORTH-WEST SIDE WALL OF THE HOUSE BESIDE THE UTILITY METER**

#17 **SERVICE DISCONNECT LOCATED IN THE BACKUP GATEWAY3 PANEL**

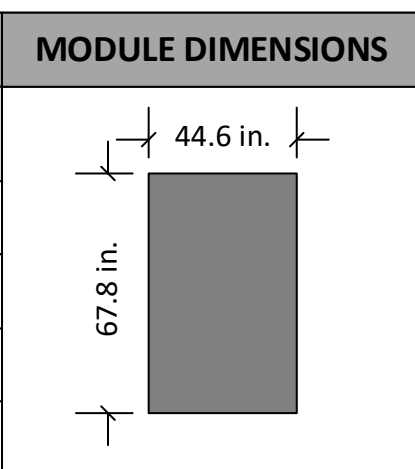
#18 **BATTERY**

#19 **MAIN BATTERY SYSTEM DISCONNECT**

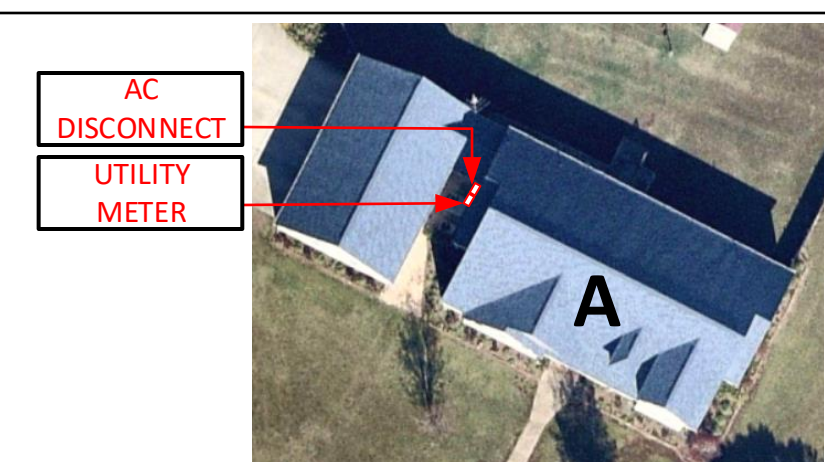
#20 **BATTERY DISCONNECT LOCATED IN THE BACKUP GATEWAY3 PANEL**

#21 **ENERGY STORAGE SYSTEM DISCONNECT**
NOMINAL ESS AC VOLTAGE 240V
NOMINAL ESS DC VOLTAGE 550V
AVAILABLE FAULT CURRENT DERIVED FROM THE ESS 10kA
DATE CALCULATION PERFORMED 08/01/2024

ROOF DESCRIPTION			
ROOF	PITCH	AZIMUTH	NO. OF MODULES
A	38°	207°	30

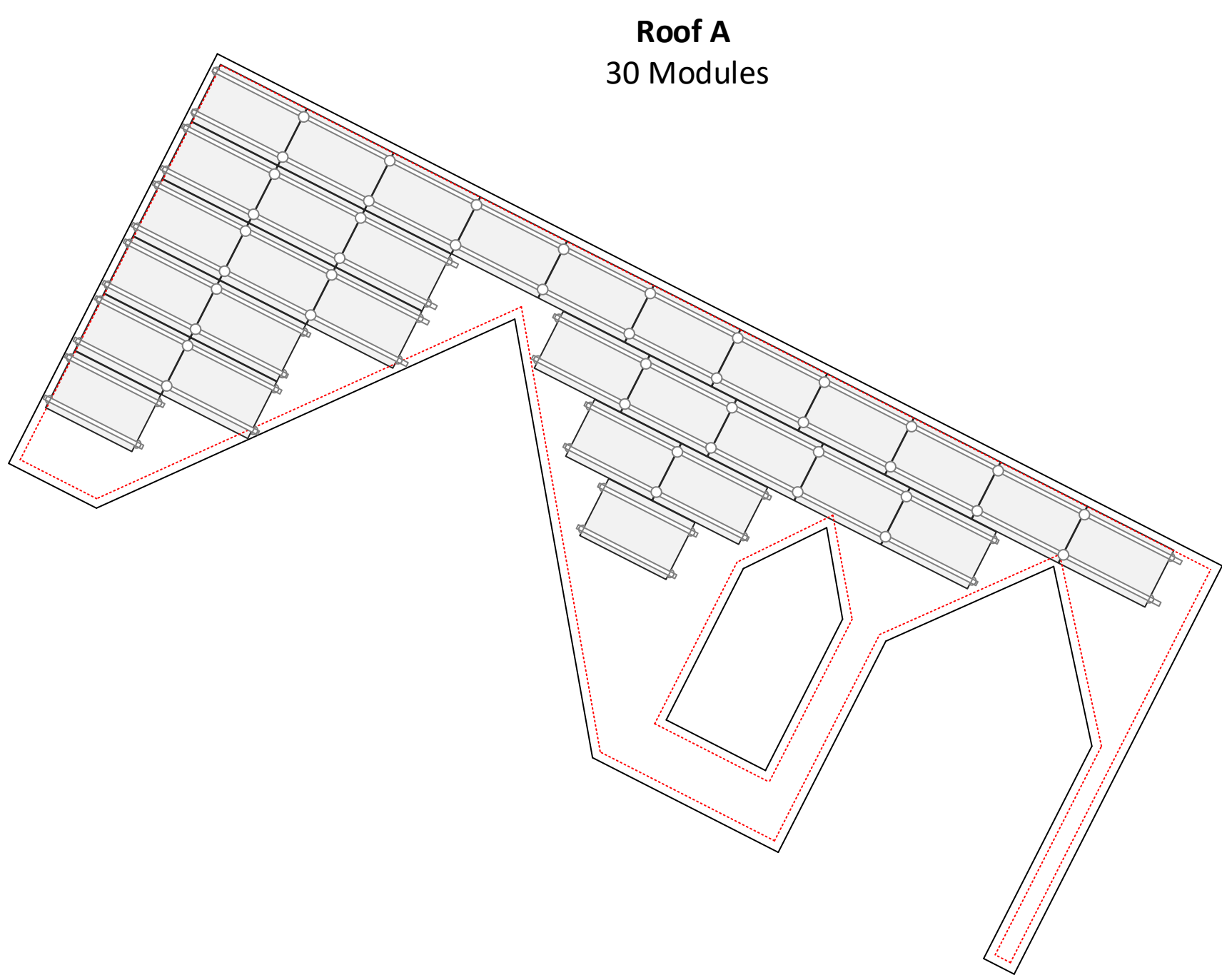


Rails and Splices : PSR-B84 (BLACK)	Roof Attachment : Pegasus Comp Mount
Rafter Spacing : 16 in	There is one layer of shingles Roofing material is asphalt shingles
Attachment Span: 4ft	The roof is located in 120mph wind zone



5112 Departure Drive,
Raleigh NC 27616
O: 919.948.6474
E: info@8msolar.com

PV LABELS		
Sr No	Code	Qty
01	02-314	12
02	03-301	01
03	03-302	01
04	02-316	02
05	03-308	01
06	03-390	01
07	03-306	01
08	05-215	02
09	05-211	02
10	03-230	01
11	05-372	01
12	05-103	01
13	05-216	01
14	05-342	01
15	07-111	01
16	8M-001	03
17	8M-002	03
18	03-395	01
19	04-304	01
20	8M-004	03
21	03-511	01



- RAILS AND MOUNTING SYSTEM**
- 56 x PSR-B84: Pegasus Rail, Black, 84" (7 Feet)
 - 38 x PSR-SPL: Pegasus - Bonded, Structural Splice
 - 42 x PSR-MCB: Pegasus - Multiclamp, Mid/End, 30 to 40 mm, Black
 - 36 x PSR-HEC: Pegasus - Hidden End Clamp
 - 11 x PSR-LUG: Pegasus - Grounding Lug
 - 45 x PSR-WMC: Pegasus - Wire Management Clip
 - 05 x PSR-CBG: Pegasus - Cable Grip
 - 36 x PSR-CAP: Pegasus - End Cap
 - 102 x PSCR-UBBDT: Pegasus Comp Mount - Open Slot, Black L Foot, Black Flashing, Dovetail 3/8" T-Bolt
 - 60 x Heyco Wire Clips
 - 03 x S6466 EdgeScreen 6" x 100' (222ft Heyco SunScreen)
 - 03 x S6438 EdgeScreen BLK - Heyco SunScreen Clips (100 Per Bag)

- SOLAR MODULES**
- 30 x Q.TRON BLK M-G2+ 425W
- INVERTER & SUPPORTING ITEMS**
- 01 x 1707000-00-J :Tesla Powerwall3
 - 10 x 1879359-00-X: Tesla MCI-2
 - 01 x 1841000-01-C: Backup GateWay 3
 - 01 x 1549184-00-X: 02" Conduit Hub Kit

- WIRE**
- 01 x WIRPV 2KVPV10STRBLK500: #10 PV WIRE BLK (Cu) 500ft

- ELECTRICAL ITEMS**
- 01 x UAT417-XGF: 200amp Meter Base
 - 01 x BRP18BC225R: Main Load Panel (225A) (NEMA 3R)
 - 01 x BRPSF225: Eaton Sub feed Lug kit
 - 01 x BW2200: Gateway Main Breaker-Eaton BW2200
 - 01 x BR260: Eaton BR 60/2
 - 02 x BR120: Eaton BR 20/1
 - 02 x BR115: Eaton BR 15/1
 - 01 x DG222URB: 250volt/60amp/2pole non fusible disconnect (NEMA 3R)
 - 01 x EATON M22PVK01: 22.5MM PB EMG STOP W/ CONTACTOR
 - 01 x Eaton M22I1PG: SFC MTG ENC Emergency Stop Enclosure
 - 01 x EZSLR JB-1.2: SolaDeck

Customer Information:

Trevor Johnson

5657 Red Hill Church
Road Coats NC 27521

Customer Signature:

Sheet Name:

Bill of Material

JOB NUMBER:

24-365-LWTJ

Date: 09/12/2024

Revision: A

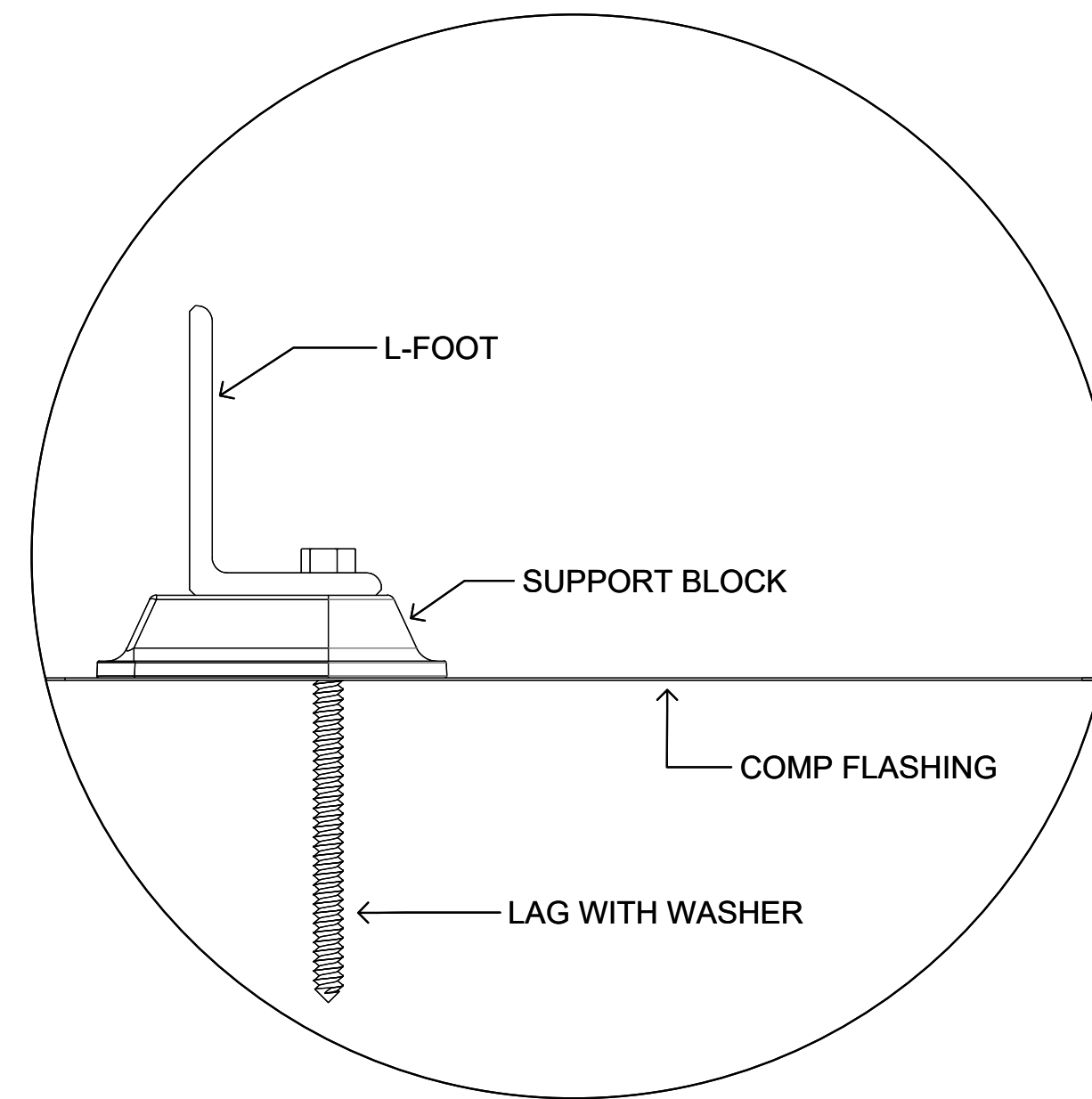
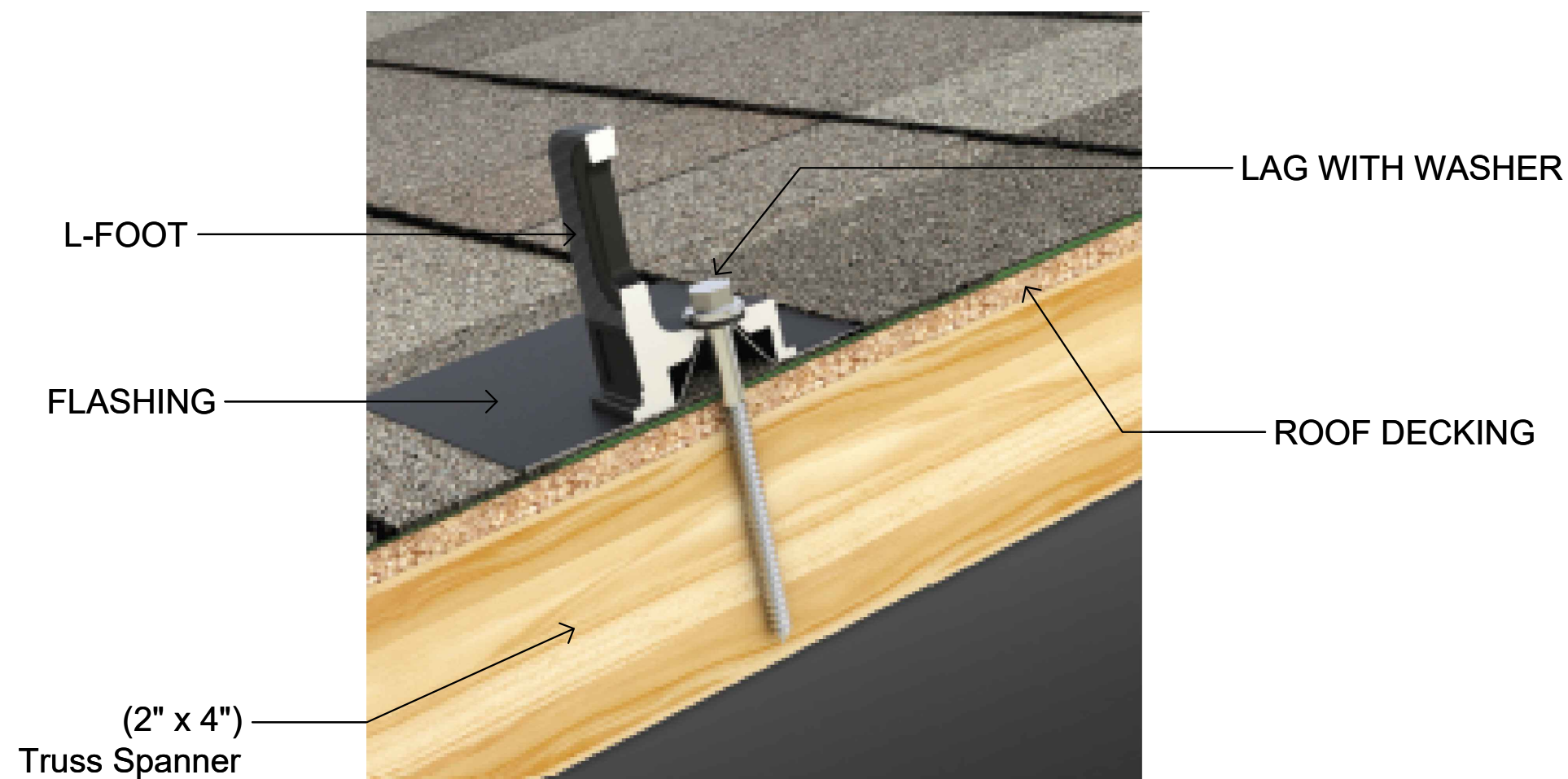
Sheet Size: ANSI C
17" X 22"

Sheet Number: PV7

6in setback from
sides of the roof

BILL OF MATERIAL
SCALE: 1/8" - 1'







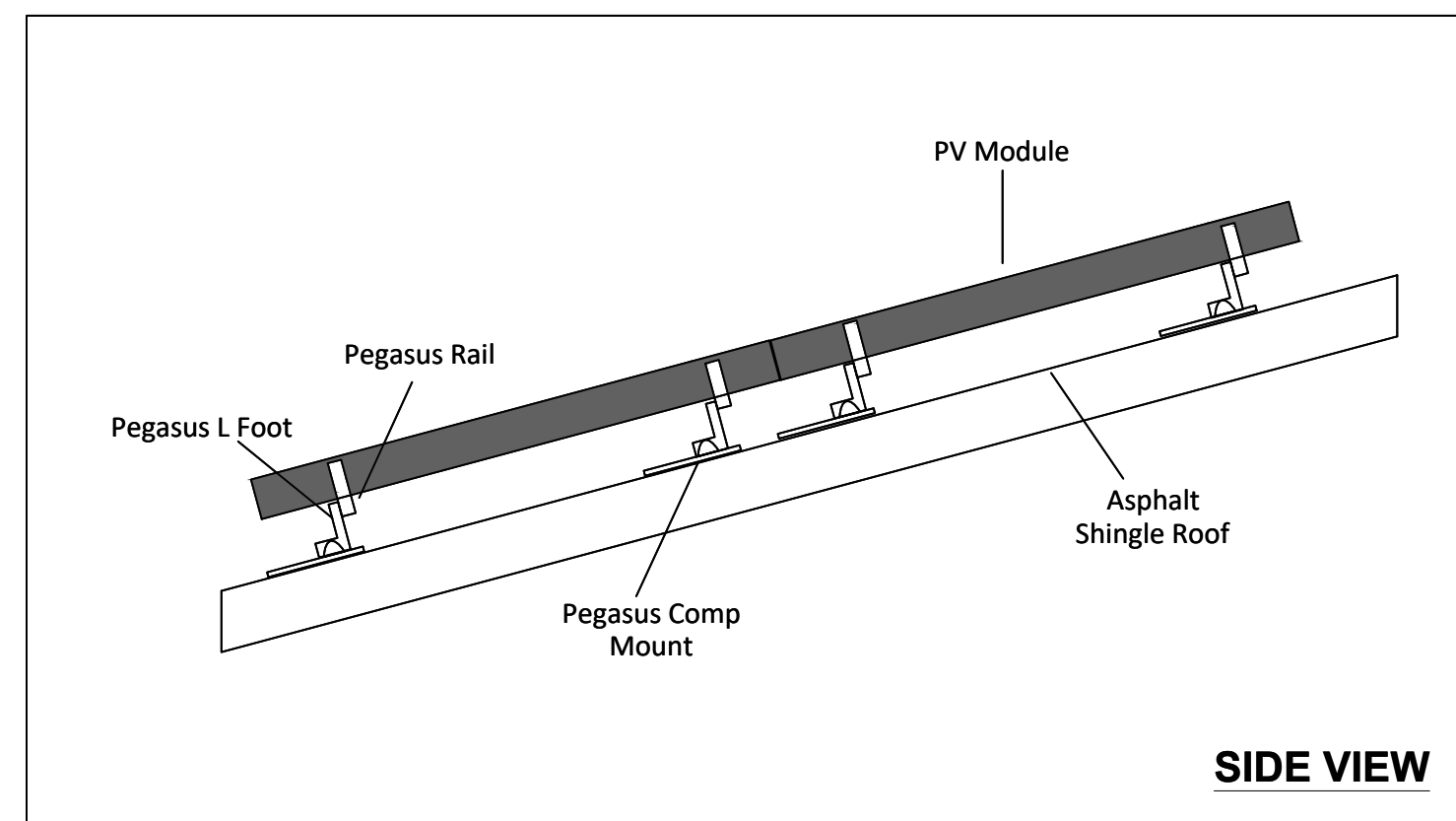
Customer Information:

Trevor Johnson

5657 Red Hill Church
Road Coats NC 27521

Customer Signature:

					
Multi-Clamp	Hidden End Clamp	MLPE Mount	Dovetail T-Bolt	Ground Lug	Cable Grip
Torque Value 100 in-lbs.	Torque Value 135 in-lbs.	Torque Value 135 in-lbs.	Torque Value 300 in-lbs.	Torque Value 135 in-lbs.	Torque Value 135 in-lbs.



Sheet Name:

Attachment Details

JOB NUMBER:

24-365-LWTJ

Date:

09/12/2024

Revision:

A

Sheet Size:

ANSI C
17" X 22"

Sheet Number:

PV8

PV Dead Load	
Roof A	<p>PV System Dead Load (Panel + Racking weight) / PV System Area (30 panels x 47.2 lbs./panel + 341 ft. of racking x 1.17 lb.ft) / (30 panels x 5.65' x 3.71') = 2.87 psf</p>