

SCOPE OF WORK

TO INSTALL A RESIDENTIAL ROOFTOP SOLAR PHOTOVOLTAIC (PV) SYSTEM.
 THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE
 UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT.
 THE PV SYSTEM DOES NOT INCLUDE BATTERIES.

ELECTRICAL NOTES

- 1) ALL EQUIPMENT TO BE LISTED BY THE UL OR OTHER NRTL AND LABELED FOR ITS APPLICATION.
- 2) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600V AND 90°C WET ENVIRONMENT.
- 3) WIRING, CONDUIT, AND RACEWAYS MOUNTED ON ROOFTOPS SHALL BE ROUTED DIRECTLY TO, AND LOCATED AS CLOSE AS POSSIBLE TO THE NEAREST RIDGE, HIP, OR VALLEY.
- 4) WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
- 5) DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
- 6) WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
- 7) ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
- 8) MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
- 9) MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER G.E.C. VIA WEEB LUG OR THE ILSCO GBL-4DBT LAY-IN LUG.
- 10) THE POLARITY OF THE GROUNDED CONDUCTORS IS (positive/negative) OR THE DC SIDE OF THE PV SYSTEM IS UNGROUNDED AND SHALL COMPLY WITH NEC 690.35

NCDOT REQUIREMENTS

OPTION 2

WEIGHT OF PV SYSTEM ON ROOF:

2.7071 PSF

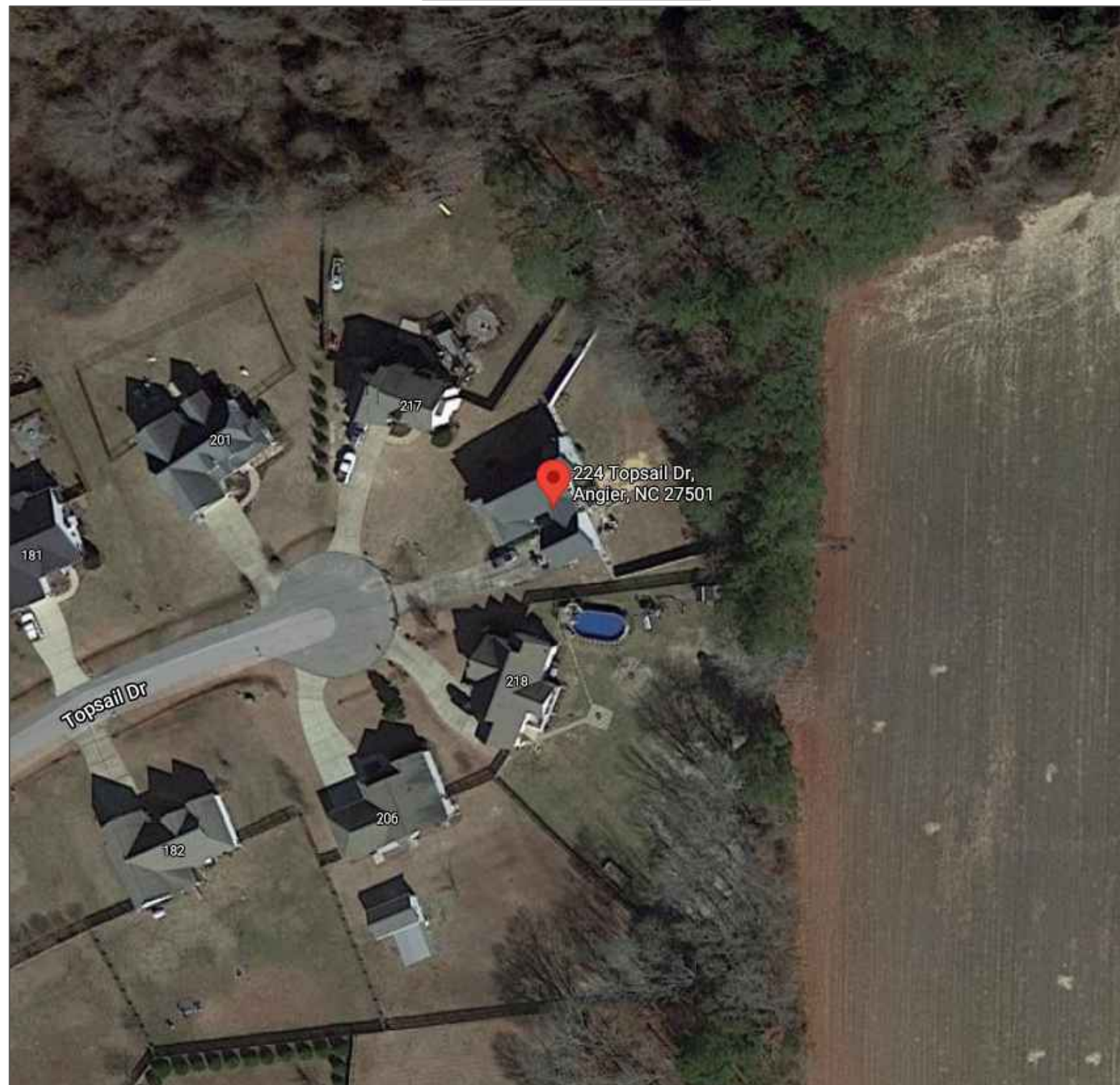
EXISTING ROOF MATERIAL TYPE:

ASPHALT SHINGLE (SINGLE LAYER)

PROJECT LOCATION WIND ZONE:

115 MPH

VICINITY MAP



CONTRACTOR



Covenant Solar Tech

DBA SUN DOLLAR ENERGY
 3200 WELLINGTON COURT SUITE 101
 RALEIGH, NC 27615
 (919) 508-6907
 NC ELE LICENSE #: 30043
 NC GC LICENSE #: 84770

PROJECT & CLIENT INFORMATION

**DAVOREN RESIDENCE
 NEW SOLAR PV SYSTEM**

SYSTEM SIZE: 9.18 KW DC
 SYSTEM SIZE: 10.0 KW AC

DENNIS DAVOREN

224 TOPSAIL DR
 ANGIER, NC 27501
 (916) 402-7771

ENGINEER OF RECORD

DRAWING BY

CST

REVISIONS

DESCRIPTION	DATE	#	BY
RELEASED FOR PERMITTING	9/1/2021	1	CST

SHEET SIZE

**ANSI B
 11" X 17"**

DATE

9/1/2021

SHEET NAME

**GENERAL
 INFORMATION**

SHEET NUMBER

COVER

DESIGN SPECIFICATIONS

CONSTRUCTION TYPE	SINGLE-FAMILY
ZONING	RESIDENTIAL
GROUND SNOW LOAD	20 PSF
WIND EXPOSURE CATEGORY	CATEGORY B
WIND SPEED	115 MPH
UTILITY PROVIDER	DUKE ENERGY PROGRESS
AHJ	TOWN OF ANGIER (HARNETT COUNTY)

SYSTEM SPECIFICATIONS

SOLAR MODULES	(27) HANWHA QCELL BLACK PANELS 340W
POWER OPTIMIZERS	(27) SOLAREEDGE P400
INVERTER(S)	(1) SOLAREEDGE SE10000H-US000BNI4
SOLAR MOUNTS	SNAPNRACK SPEEDSEAL FOOT
SOLAR RACKING SYSTEM	SNAPNRACK ULTRA RAIL 40 WITH SNAPNRACK SKIRTING
MONITORING	YES
POINT OF INTERCONNECT	BUCHANAN BTC 4/0-10 TAP CONNECTORS IN M/M

SHEET INDEX		GOVERNING CODES
COVER	GENERAL INFORMATION	NFPA 70 NATIONAL ELECTRICAL CODE 2017
PV-1	SITE PLAN	2018 INTERNATIONAL BUILDING CODE
PV-2	ROOF LAYOUT AND MOUNTING DETAIL	2018 NORTH CAROLINA BUILDING CODE
PV-3	ELECTRICAL SCHEMATIC	2018 NORTH CAROLINA RESIDENTIAL CODE
PV-4	AMPACITY CALCULATIONS AND WIRE SIZING	UNDERWRITERS LABORATORIES (UL) STANDARDS
PV-5	LABELING SCHEDULE	OSHA 29 CFR 1910.269
CUTSHEETS	MANUFACTURER SPECIFICATION SHEETS	NORTH CAROLINA DEPARTMENT OF INSURANCE

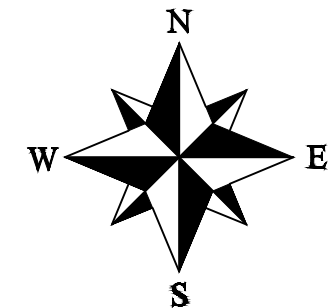
PROPERTY PLAN

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

DRIVEWAY

PROPERTY LINE

(27) HANWHA QCELL
BLACK PANELS 340W



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SITE PLAN

SHEET NUMBER

PV-1

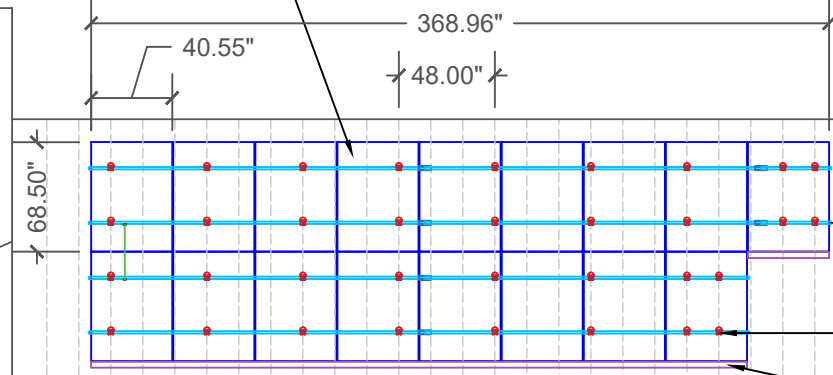
ROOF PLAN

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

ROOF 1 PITCH: 37°
 ROOF 1 AZIMUTH: 154°
 ROOF 2 PITCH: 37°
 ROOF 2 AZIMUTH: 154°

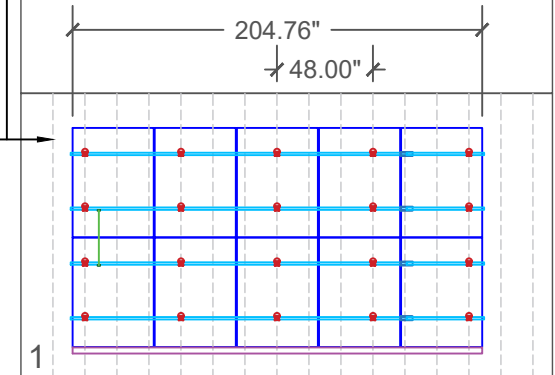
NOTE:
 MAXIMUM ALLOWABLE MOUNTING SPACING IS 68".
 MAXIMUM CANTILEVER DISTANCE IS 1/3 OF THE
 MAXIMUM ALLOWABLE SPACING AND NEVER EXCEEDS 24".

(27) HANWHA QCELL
 BLACK PANELS 340W



SNAPNRACK
 ULTRA RAIL 40
 SNAPNRACK SPEEDSEAL FOOT
 SNAPNRACK SKIRTING

ASPHALT SHINGLE (SINGLE LAYER) ROOF
 2X8 RAFTERS @ 16" O.C.

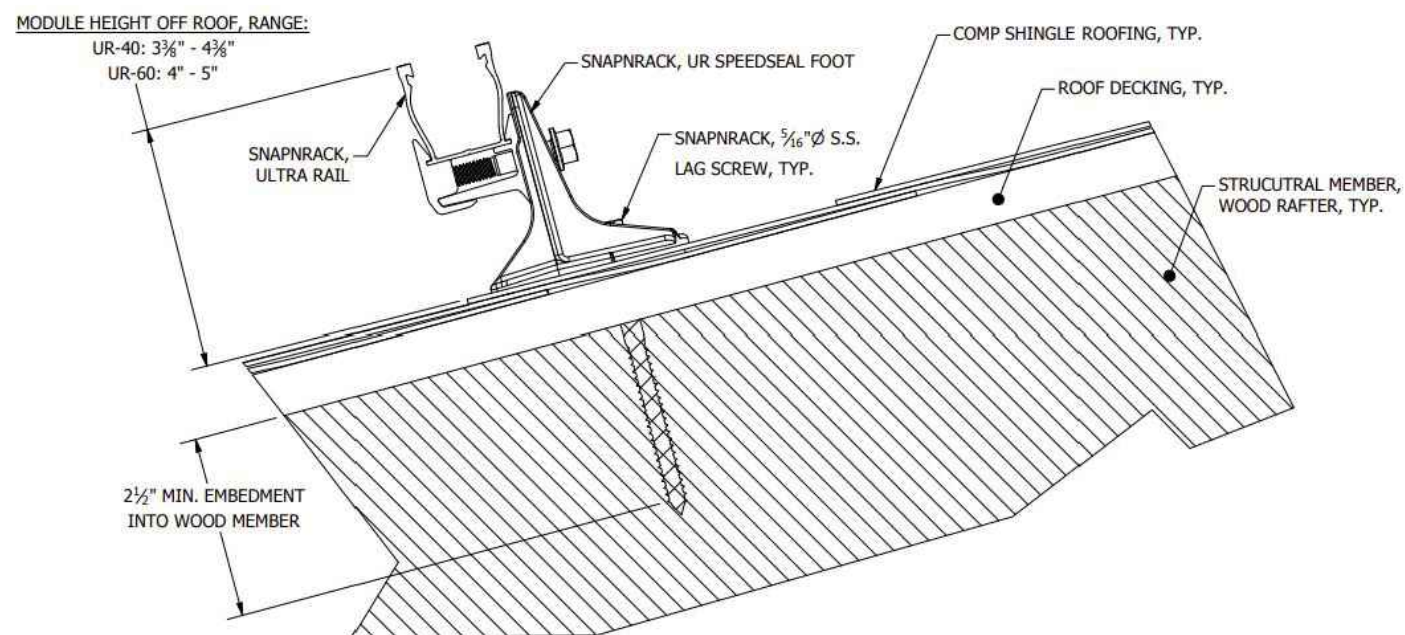


Racking	
Manufacturer	SnapNrack
Model Number	Ultra Rail 40
Length	168"
Width	1.54"
Height	1.89"
Weight	0.56 Lbs./Ft
Material	Aluminum
Structural	IBC Compliant
UL Listing	UL 2703

Flashings/Mounts	
Manufacturer	SnapNrack
Mount Type	SpeedSeal
Fastener Type	Lag Screw
Fastener Material	18-8 Stainless Steel
Fastener Size	5/16" x 4"
L-Foot Material	Aluminum
Sealing Washer	EPDM Bonded SS
Sealing Washer Size	5/16" ID x 3/4" OD
Weight	0.7565 Lbs.
Structural	IBC Compliant
UL Listing	UL 2703

LOAD CALCULATIONS		
NUMBER OF MODULES	27	
MODULE WEIGHT	43.9	LBS
MODULE SQ FT	19.313	SQ FT
TOTAL MODULE WEIGHT	1185.3	LBS
TOTAL MODULE SQ FT	521.451	SQ FT
NUMBER OF PORTRAIT	27	
NUMBER OF LANDSCAPE	0	
NUMBER OF OPTIMIZERS	27	
WEIGHT PER OPTIMIZER	1.5	LBS
TOTAL OPTIMIZER WEIGHT	40.5	LBS
TOTAL LENGTH OF RAIL	186	LF
RAIL WEIGHT PER FOOT	0.56	LBS
TOTAL RAIL WEIGHT	104.16	LBS
NUMBER OF FLANGES	54	
WEIGHT PER FLANGE	1.22	LBS
WEIGHT PER SYSTEM	65.88	LBS
NUMBER OF MID CLAMPS	46	
MID CLAMP WEIGHT	0.21	LBS
WEIGHT PER SYSTEM	9.66	LBS
NUMBER OF END CLAMPS	16	
END CLAMP WEIGHT	0.32	LBS
WEIGHT PER SYSTEM	5.12	LBS
NUMBER OF SPLICES	10	
WEIGHT PER SPLICE	0.1	LBS
WEIGHT PER SYSTEM	1	LBS
TOTAL ARRAY WEIGHT	1411.62	LBS
POINT LOAD	26.141111	LBS/FT
TOTAL ARRAY AREA	521.451	SQ FT
ARRAY DEAD LOAD	2.7071	PSF

SOLAR MOUNTING DETAIL



LEGEND

UTILITY METER	DC DISCONNECT	PV METER	RAILS
MAIN SERVICE PANEL	JUNCTION BOX	EXTERIOR CONDUIT	GROUNDING
INVERTER	SUBPANEL	GAS METER	RAIL SPLICE
AC DISCONNECT	LOAD CENTER	FLASHINGS	

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**ROOF LAYOUT &
 DETAIL DRAWINGS**

SHEET NUMBER

PV-2

Solar PV Module Data	
Manufacturer	Hanwha
Model Number	Q-Peak DUO BLK-G6+
Max Power (Pmax)	340
Max Power Voltage (Vmp)	33.94
Max Power Current (Imp)	10.02
Open Circuit Voltage (Voc)	40.66
Short Circuit Current (Isc)	10.52
Max Series Fuse (OCPD)	20
Max System Voltage	1000
UL Listing	UL1703
Protection Rating	IP67

Power Optimizer Data	
Manufacturer	SolarEdge
Model Number	P400
Rated DC Input Power	400
Max Input Voltage	80
Max Input Current	12.63
Max Short Circuit Current	10.1
Max Output Voltage	60
Max Output Current	15
UL Listing	UL1741
Protection Rating	IP68/NEMA6P

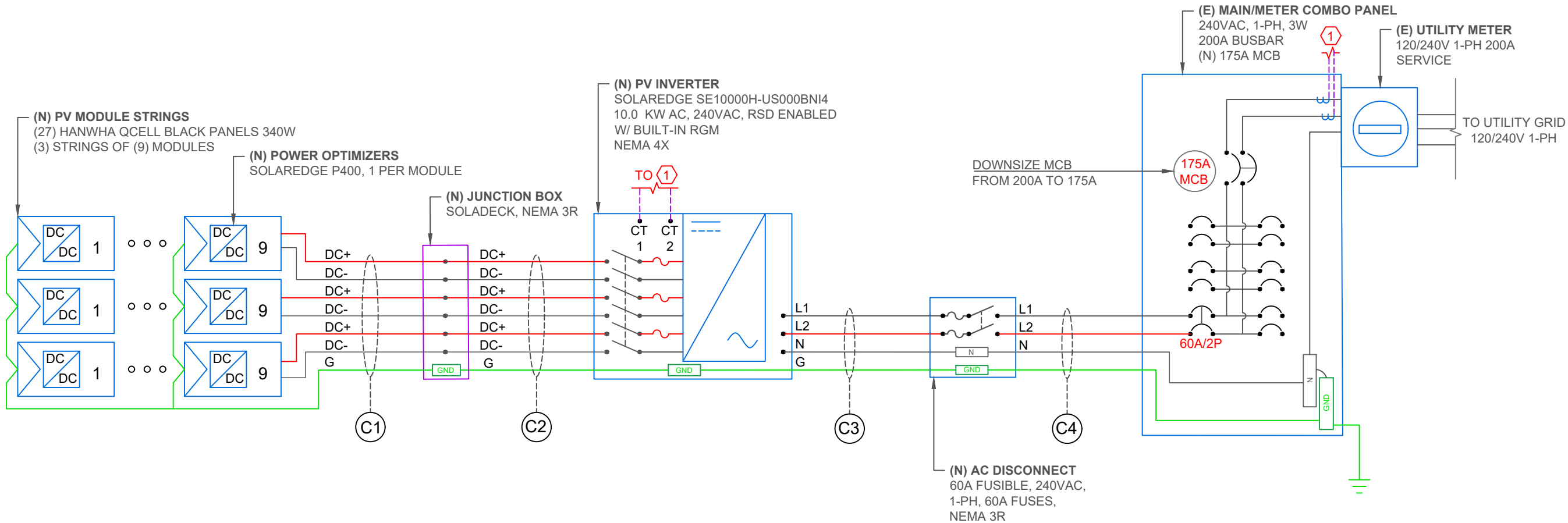
Junction Box Data	
Manufacturer	Soladeck
Model Number	0799-5B
Voltage Rating	600
Amperage Rating	120
UL Listing	UL 50
Enclosure Rating	NEMA 3R

Inverter Data	
Manufacturer	SolarEdge
Model Number	SE10000H -US000BNI4
Max DC Input Voltage	480
Nominal DC Input Voltage	400
Max DC Input Current	27
Max DC Short Circuit Current	45
Max DC Input Power	15500
Max AC Output Power	10000
Nominal AC Output Voltage	240
Max AC Output Current	42
Strings Per Inverter	1 - 3
UL Listing	UL1741
Enclosure Rating	NEMA 4X

AC Disconnect Data	
Manufacturer	Eaton
Model Number	DG222NRB
Voltage Rating	240
Amperage Rating	60A
Phase	Single
Switch Style	Fusible
Fuse Rating	60A
UL Listing	UL 98
Enclosure Rating	NEMA 3R


Main/Meter Combo Panel Data	
Manufacturer	Eaton (CH)
Model Type	Type BR Breakers
Model Number	MBE4040B200BTS
Voltage Rating	120/240
Busbar Amp Rating	200A
Main Breaker/Main Lug	Main Breaker
Breaker Amp Rating	175A
Phase	Single
UL Listing	UL 6294
Enclosure Rating	NEMA 3R

Temperature Data	
Average High Temp	93.2° F
Record Low Temp	10.4° F



WIRE SCHEDULE													
TAG	CURRENT CARRYING CONDUCTORS				GROUNDING CONDUCTORS				CONDUIT/RACEWAY				NOTES
	QTY.	SIZE	MATERIAL	INSULATION TYP.	QTY.	SIZE	MATERIAL	INSULATION TYP.	QTY.	SIZE	MATERIAL	LOCATION	
C1	6	10 AWG	COPPER	PV WIRE	1	8 AWG	BARE COPPER	N/A	-	-	-	FREE AIR	
C2	6	10 AWG	COPPER	THHN/THWN-2	1	10 AWG	COPPER	THHN/THWN-2	1	3/4"	LFMC/EMT	EXTERIOR/INTERIOR	
C3	3	6 AWG	COPPER	THHN/THWN-2	1	10 AWG	COPPER	THHN/THWN-2	1	3/4"	LFNC/EMT	EXTERIOR	
C4	3	6 AWG	COPPER	THHN/THWN-2	1	10 AWG	COPPER	THHN/THWN-2	1	3/4"	LFNC/EMT	EXTERIOR	
XC	-	-	-	-	-	-	-	-	-	-	-	-	

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SHEET NAME
 ELECTRICAL SCHEMATIC

SHEET NUMBER
 PV-3

Ampacity Calculations

Wiring Location: Module to Power Optimizer (Direct Current)
 Wiring Location: Inverter to Service Entrance (Alternating Current)
 All calculations show minimum sizing for ampacity
 Actual wire sizing may be larger for voltage drop or other factors
 All calculations are according to the 2017 National Electric Code

Modules: Hanwha Q-Peak DUO BLK-G6+ 340
 Inverter: SolarEdge SE10000H-US

Initial Input Values

Isc (Short Circuit Current)	10.52				
Number of circuits	10.52	x	1	=	10.52
Maximum Circuit Current (NEC 690.8 (A)(1+2))	10.52	x	156%	=	16.4112
Minimum Overcurrent Device	20	A	Series Fuse Rating by Manufacturer		
	Size AWG #				
Chosen Conductor Type (THHN, RHW-2, or USE-2)	10				

Conductor Derating

NEC 690.31 © ref (NEC 310.16)					
Conductor 90°C Ampacity	40				
Conduit Fill Derating	1-3	40	x	1	= 40
Temperature Derating (°F)	141-149	40	x	0.65	= 26

Ampacity vs Overcurrent Device

Conductor Ampacity Check	26	16.4112	OK
Conductor to Overcurrent Check	26	20	OK

Input Data Into Yellow Fields

Green Field must say OK

Use this calculation for over current protection and wire sizing for stringers coming from Solar Panels.
 Isc comes from manufacturer

Ampacity Calculations

Wiring Location: Inverter to Service Entrance (Alternating Current)
 All calculations show minimum sizing for ampacity
 Actual wire sizing may be larger for voltage drop or other factors
 All calculations are according to the 2017 National Electric Code

Modules: Hanwha Q-Peak DUO BLK-G6+ 340
 Inverter: SolarEdge SE10000H-US

Initial Input Values

Inverter Continuous AC Output Combined (Watts)	10000
Minimum Operating Voltage	240

Watts	Volts	=	Amps
10000	240	=	42
Inverter Continuous AC Amps	42		
Number of Inverters	42	x	1 = 42

Overcurrent Device Rating

NEC 690.8 (B)(3)	42	x	125%	=	52.5
Minimum Overcurrent Device	60	Amps			
Circuit Breaker Size per NEC 240.6(A)	60	Amps			

Size AWG #

Chosen Conductor Type	6
THHN, THWN, RHW-2 or USE-2	

Conductor Derating

NEC 690.31© ref (NEC 310.16)					
Conductor 90°C Ampacity	75				
Conduit Fill Derating	1-3	75	x	1	= 75
Temperature Derating (°F)	105-113	75	x	0.87	= 65.25

Ampacity vs Overcurrent Device

Conductor Ampacity Check	65.25	52.5	OK
Conductor to Overcurrent Check	65.25	60	OK

Input Data into Yellow Fields

Green Fields must say OK

Use this calculation for over current protection and wire sizing for inverter

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AMPACITY
 CALCULATIONS

SHEET NUMBER

PV-4

PV LABELS

- SIGNAGE REQUIREMENTS**
- > WARNING SIGNS OR LABELS SHALL COMPLY WITH NEC 110.21(B)
 - > MIN. 3/8" LETTER HEIGHT
 - > ALL CAPITAL LETTERS
 - > ARIAL OR SIMILAR FONT
 - > REFLECTIVE, WEATHER RESISTANT MATERIAL, UL 969

PHOTOVOLTAIC SYSTEM
⚠ DC DISCONNECT ⚠

RATED MMP CURRENT	AMPS
RATED MPP VOLTAGE	VOLTS
MAX SYSTEM VOLTAGE	VDC
MAX CIRCUIT CURRENT	AMPS

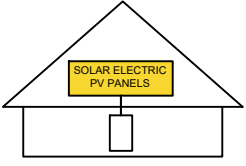
NEC 690.53 1
 APPLY TO:
 INVERTER

WARNING: PHOTOVOLTAIC POWER SOURCE

NEC 690.31(G)(3)(4) 2
 APPLY TO:
 SOLAR DC RACEWAYS
 DC JUNCTION BOXES

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



NEC 690.56(C)(1)(a) 3
 APPLY TO:
 MAIN SERVICE DISCONNECT

⚠ WARNING

ELECTRIC SHOCK HAZARD

TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

NEC 690.13(B) 4
 APPLY TO:
 DISCONNECTS
 COMBINER BOXES

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

NEC 690.56(C)(3) 5
 APPLY TO:
 INVERTERS

PHOTOVOLTAIC SYSTEM
⚠ AC DISCONNECT ⚠

OPERATING VOLTAGE	VAC
OPERATING CURRENT	AMPS

NEC 690.54 6
 APPLY TO:
 AC DISCONNECT

⚠ WARNING

THIS EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES, EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE, SHALL NOT EXCEED AMPACITY OF BUSBAR

NEC 705.12 (B)(2)(3)(c) 7
 APPLY TO:
 SERVICE PANEL(S)

⚠ WARNING


THE DISCONNECTION OF THE GROUNDED CONDUCTOR(S) MAY RESULT IN OVERVOLTAGE ON THE EQUIPMENT

NEC 690.31 (I) 8
 APPLY TO:
 INVERTER(S)

MAIN PV SYSTEM DISCONNECT

NEC 690.13 (B) 9
 APPLY TO:
 MAIN AC DISCONNECT

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