PROJECT DESCRIPTION:

13 X 320 HANWHA QCELL Q.PEAK DUO-G5 320 (320 WATT) MODULES
ROOF MOUNTED SOLAR PHOTOVOLTAIC MODULES

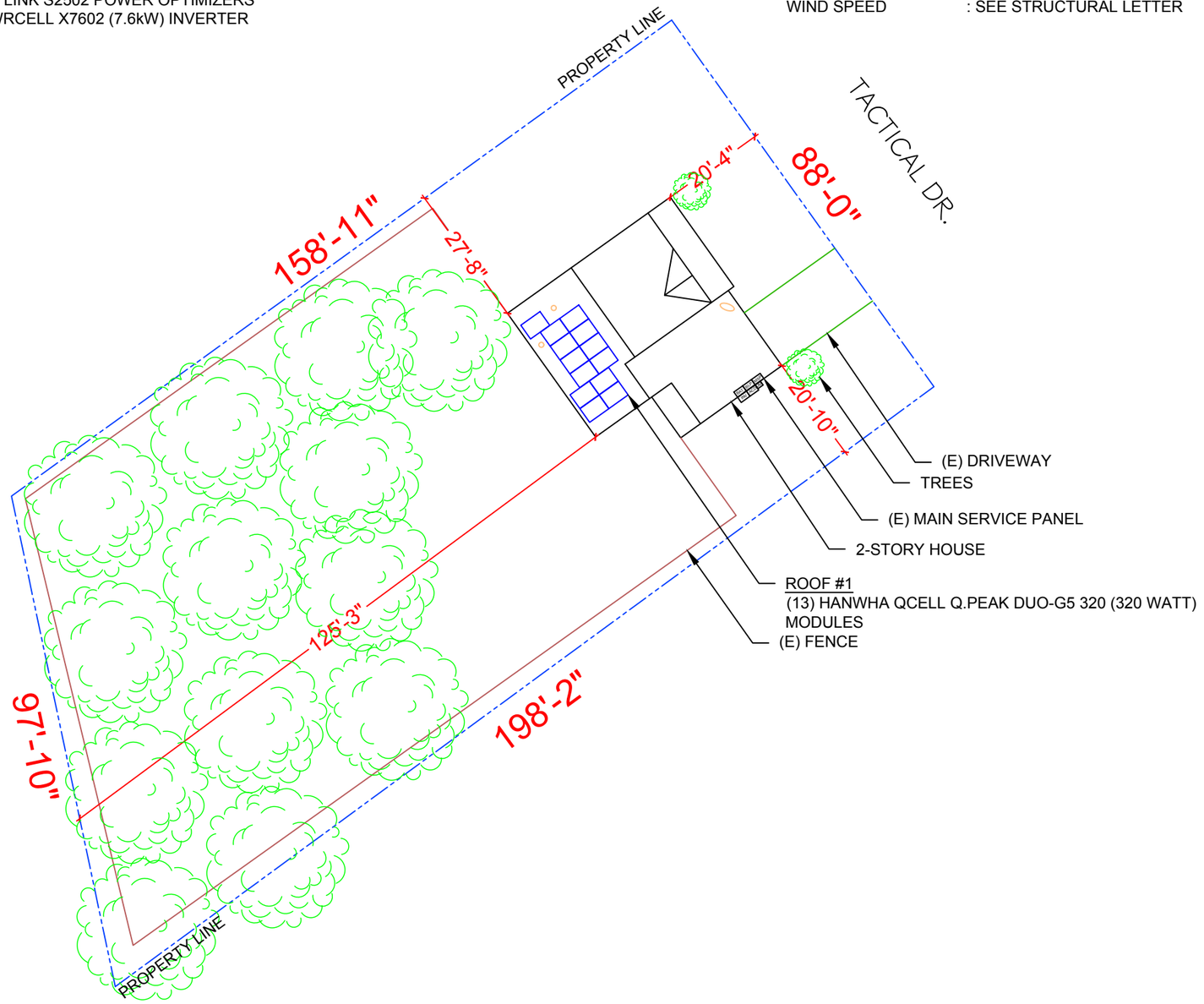
SYSTEM SIZE:4.16 kW DC STC
ARRAY AREA: ROOF#1 - 235.82 SQ FT

EQUIPMENT SUMMARY
13 HANWHA QCELL Q.PEAK DUO-G5 320 (320 WATT) MODULES
02 GENERAC PV LINK S2502 POWER OPTIMIZERS
01 GENERAC PWRCELL X7602 (7.6kW) INVERTER

AUTHORITIES HAVING JURISDICTION
BUILDING : HARNETT COUNTY
ZONING : HARNETT COUNTY
UTILITY : DUKE ENERGY

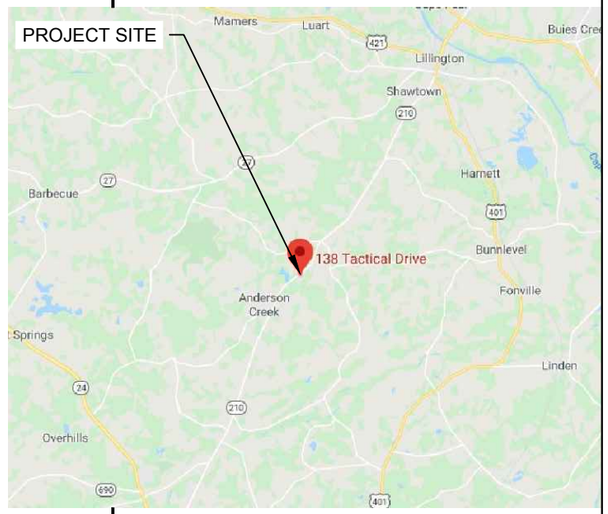
APPLICABLE CODES & STANDARDS
NCBC 2018
NEC 2017

DESIGN SPECIFICATIONS
OCCUPANCY : II
CONSTRUCTION : SINGLE-FAMILY
ZONING : RESIDENTIAL
GROUND SNOW LOAD : SEE STRUCTURAL LETTER
WIND EXPOSURE : SEE STRUCTURAL LETTER
WIND SPEED : SEE STRUCTURAL LETTER



1 PLOT PLAN & VICINITY MAP
PV-1 SCALE: 1"=25'-0"

2 HOUSE PHOTO
PV-1 SCALE: NTS



3 VICINITY MAP
PV-1 SCALE: NTS

SHEET INDEX

PV-1	PLOT PLAN & VICINITY MAP
PV-2	ROOF PLAN & MODULES
PV-2A	STRING LAYOUT
PV-3	ATTACHMENT DETAIL
PV-4	ELECTRICAL LINE DIAGRAM
PV-5	WIRING CALCULATIONS
PV-6 to 12	EQUIPMENT SPECIFICATIONS

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Email: info@powerhome.com
Web: www.powerhome.com

REVISIONS

DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS
RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

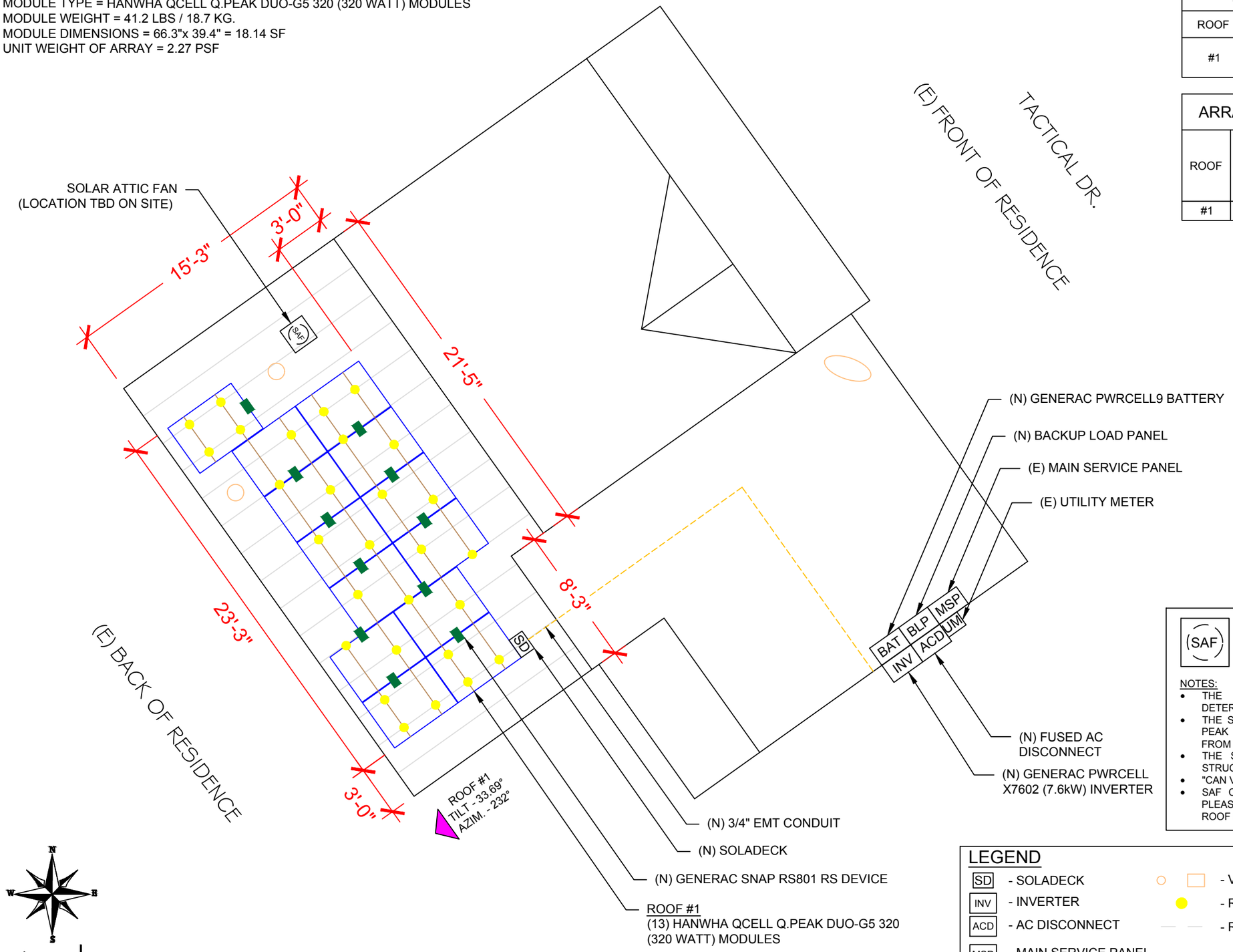
SHEET NAME
PLOT PLAN & VICINITY MAP

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-1

MODULE TYPE, DIMENSIONS & WEIGHT

NUMBER OF MODULES = 13 MODULES
MODULE TYPE = HANWHA QCELL Q.PEAK DUO-G5 320 (320 WATT) MODULES
MODULE WEIGHT = 41.2 LBS / 18.7 KG.
MODULE DIMENSIONS = 66.3"x 39.4" = 18.14 SF
UNIT WEIGHT OF ARRAY = 2.27 PSF



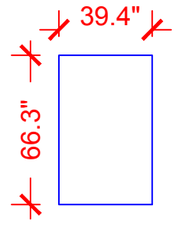
1 ROOF PLAN & MODULES
PV-2 SCALE: 1"=6'-0"

ROOF DESCRIPTION

ROOF TYPE			COMPOSITION SHINGLE	
ROOF	ROOF TILT	AZIMUTH	FRAMING SIZE	FRAMING SPACING
#1	33.69°	232°	SEE STRUCTURAL LETTER	

ARRAY AREA & ROOF AREA CALC'S

ROOF	# OF MODULES	ARRAY AREA (Sq. Ft.)	ROOF AREA (Sq. Ft.)	ROOF AREA COVERED BY ARRAY (%)
#1	13	235.82	434.28	54



HANWHA QCELL Q.PEAK DUO-G5 320 (320 WATT)

(SAF) SOLAR ATTIC FAN

NOTES:
- THE LOCATION OF THE SAF SHOULD BE DETERMINED ON SITE.
- THE SAF SHOULD BE LOCATED 30"-36" FROM THE PEAK OF THE ROOF OR ABOUT 5 ROWS DOWN FROM THE RIDGE.
- THE SAF SHOULD NOT BE MOUNTED ON ANY STRUCTURAL MEMBER LIKE TRUSS/RAFTER.
- "CAN VENTS" CAN BE REPLACED BY SAF.
- SAF CANNOT BE MOUNTED ON A METAL ROOF. PLEASE CARRY GABLE VENT FANS FOR METAL ROOF INSTALLATION (IF APPLICABLE).

LEGEND

SD	- SOLADECK		- VENT, ATTIC FAN (ROOF OBSTRUCTION)
INV	- INVERTER		- ROOF ATTACHMENT
ACD	- AC DISCONNECT		- RAFTERS
MSP	- MAIN SERVICE PANEL		- CONDUIT
BLP	- BACKUP LOAD PANEL	BAT	- BATTERY
OP	- PV LINK OPTIMIZER		- RAPID SHUTDOWN

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Web: www.powerhome.com

REVISIONS

DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

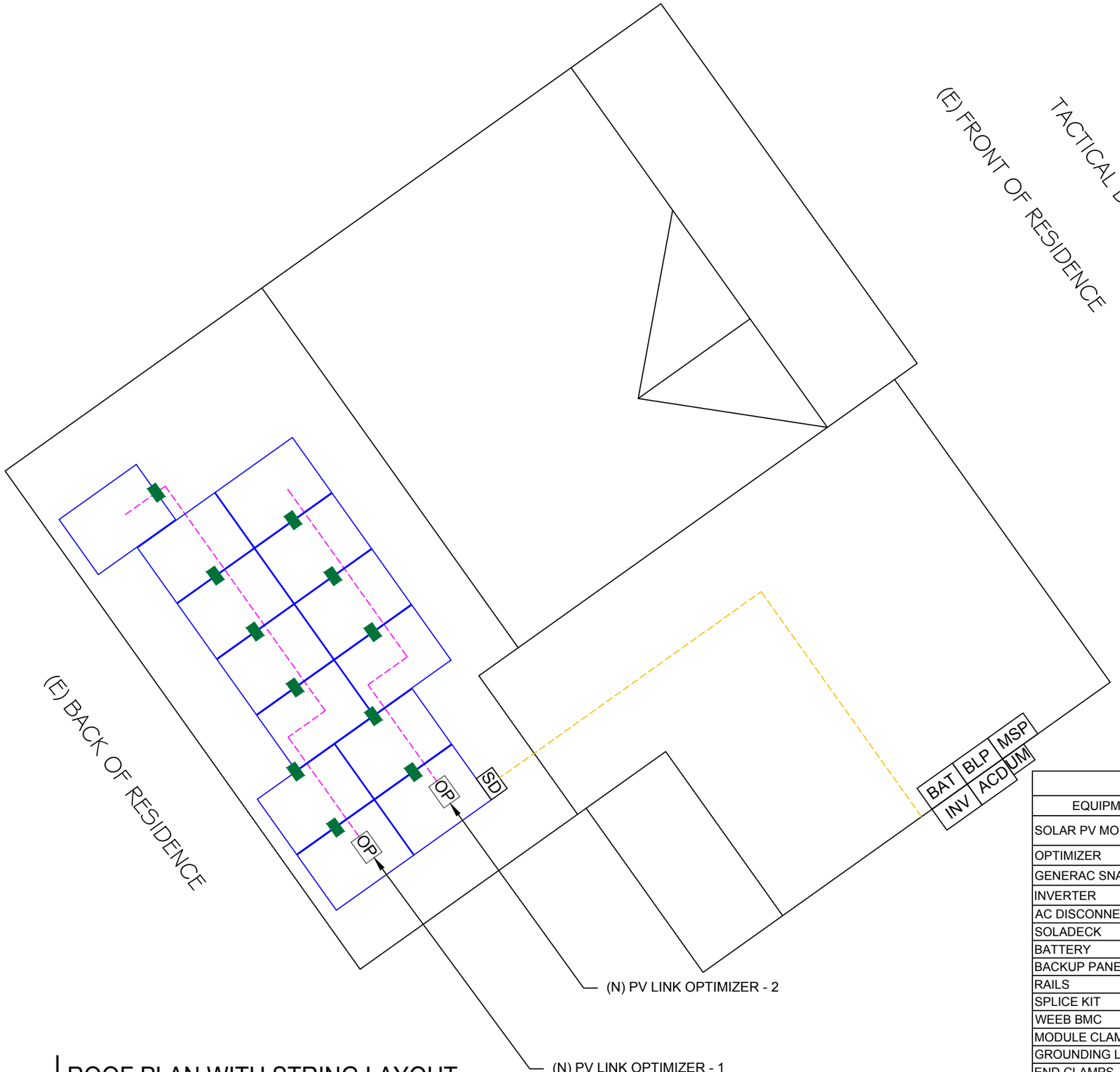
PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
ROOF PLAN & MODULES

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-2



1 ROOF PLAN WITH STRING LAYOUT

PV-2A SCALE: 3/16" = 1'-0"

BILL OF MATERIALS		
EQUIPMENT	QTY	DESCRIPTION
SOLAR PV MODULE	13	HANWHA QCELL Q.PEAK DUO-G5 320 (320 WATT) MODULES
OPTIMIZER	02	GENERAC PV LINK S2502 POWER OPTIMIZERS
GENERAC SNAP RS	13	GENERAC SNAPRS MODEL RS801
INVERTER	01	GENERAC PWRCELL X7602 (7.6KW) INVERTER
AC DISCONNECT	1	60A FUSED, (2) 40A FUSES, 240V, NEMA 3R, UL LISTED
SOLADECK	1	SOLADECK 600 V, NEMA 3R, UL LISTED
BATTERY	1	GENERAC PWRCELL9 BATTERY
BACKUP PANEL	1	125A, BACKUP PANEL, 240V
RAILS	8	QRAIL LIGHT 14 FT. BLACK
SPLICE KIT	2	QSPLICE INTERNAL LIGHT
WEEB BMC	4	WEEB BMC MILL
MODULE CLAMPS	18	UNIVERSAL MID CLAMP
GROUNDING LUG	4	WEEB LUG W/ T-BOLT
END CLAMPS	20	UNIVERSAL END CLAMPS
ATTACHMENT	32	L-MOUNT ATTACHMENT (QUICKMOUNT)
T-BOLT	45	T-BOLT W/ NUT M8 X 20MM

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REVISIONS		
DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

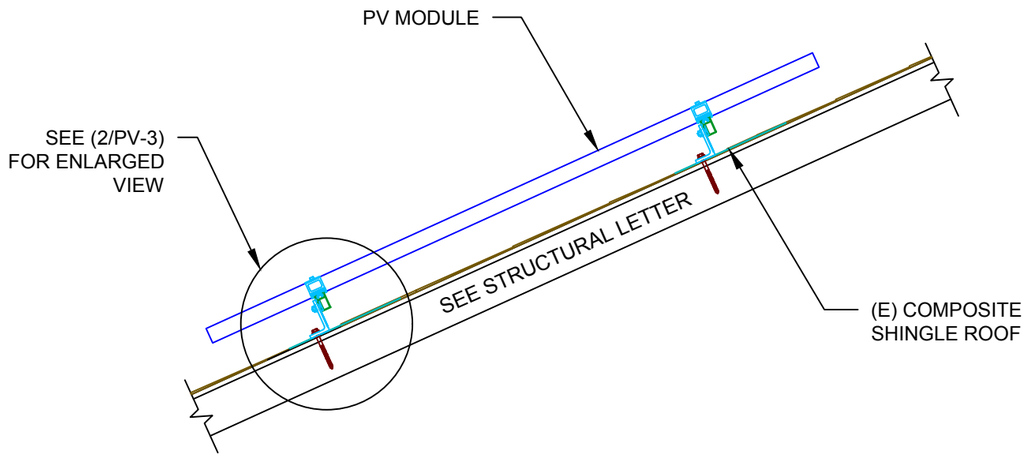
PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
STRING LAYOUT

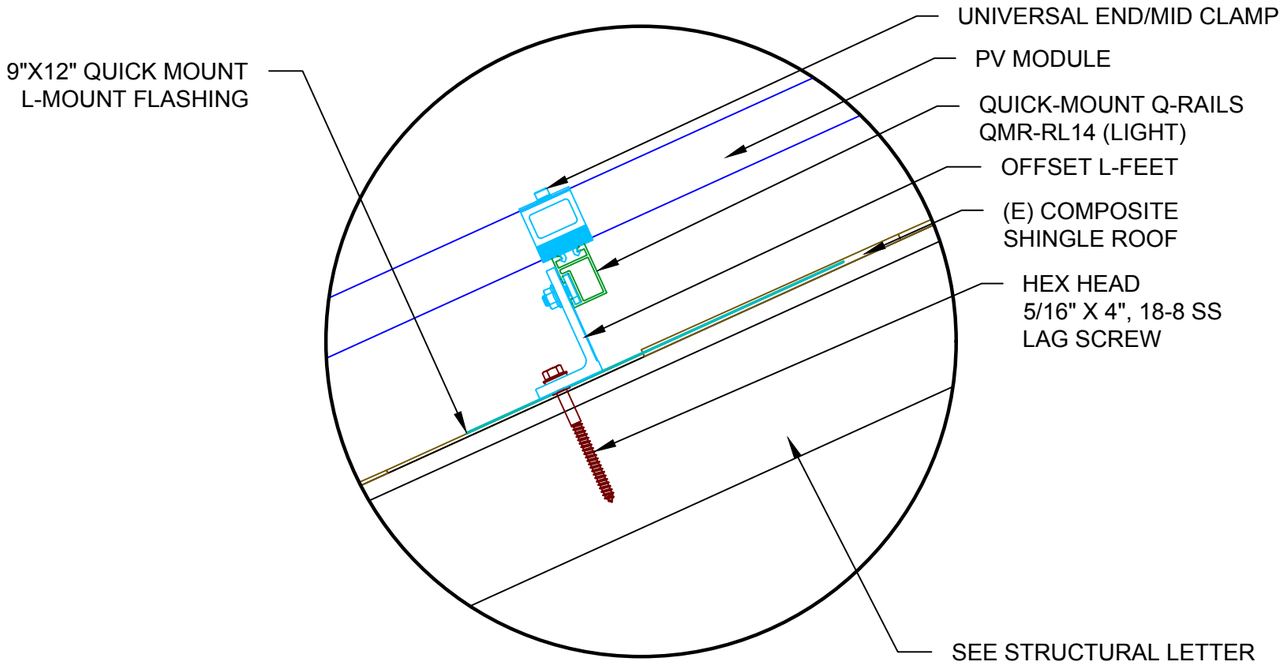
SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-2A



1 ATTACHMENT DETAIL

PV-3 SCALE: 1" = 1'-0"



2 ATTACHMENT DETAIL (enlarged view)

PV-3 SCALE: NTS

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DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS
RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
ATTACHMENT DETAIL

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-3

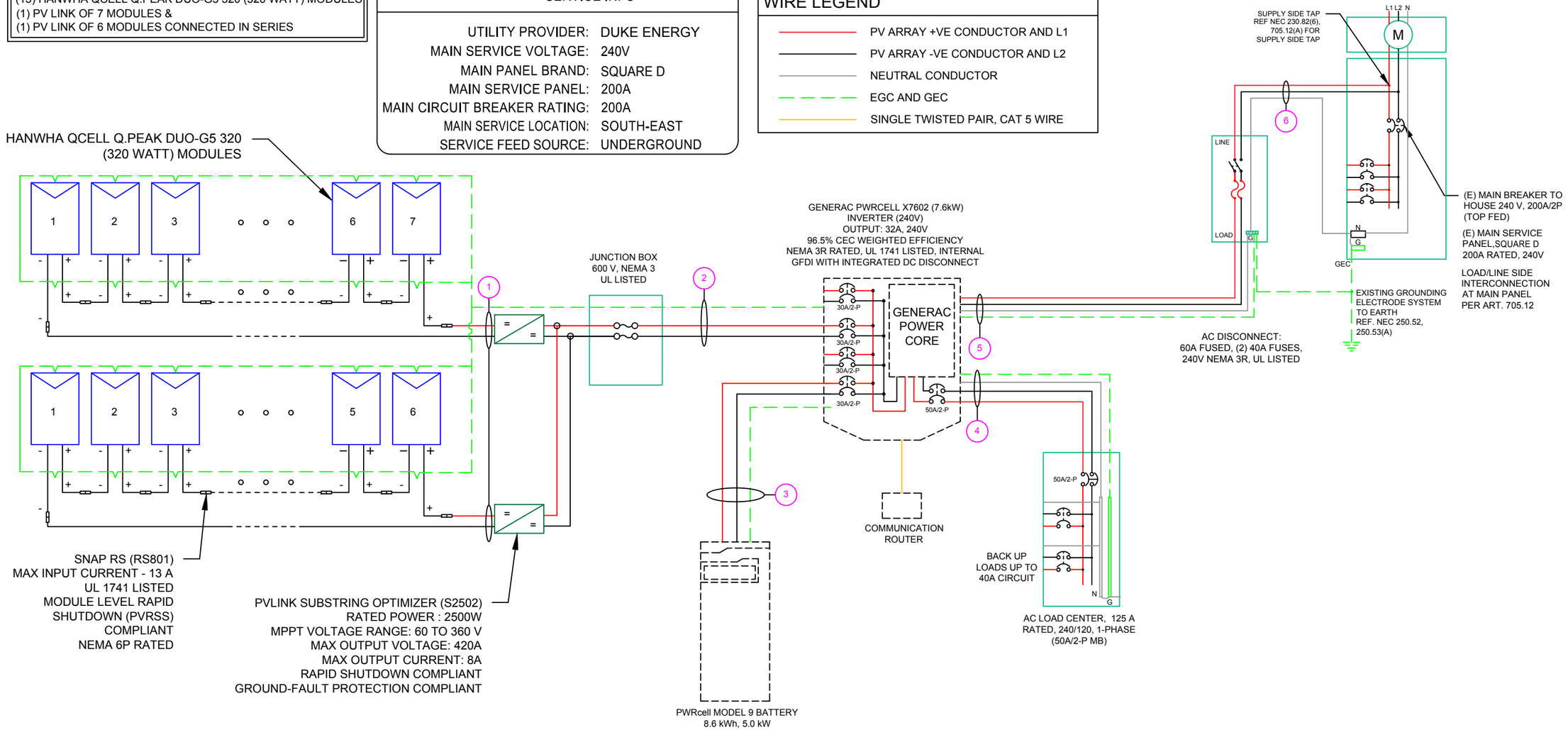
(13) HANWHA QCELL Q.PEAK DUO-G5 320 (320 WATT) MODULES
(1) PV LINK OF 7 MODULES &
(1) PV LINK OF 6 MODULES CONNECTED IN SERIES

SERVICE INFO

UTILITY PROVIDER:	DUKE ENERGY
MAIN SERVICE VOLTAGE:	240V
MAIN PANEL BRAND:	SQUARE D
MAIN SERVICE PANEL:	200A
MAIN CIRCUIT BREAKER RATING:	200A
MAIN SERVICE LOCATION:	SOUTH-EAST
SERVICE FEED SOURCE:	UNDERGROUND

WIRE LEGEND

- PV ARRAY +VE CONDUCTOR AND L1
- PV ARRAY -VE CONDUCTOR AND L2
- NEUTRAL CONDUCTOR
- EGC AND GEC
- SINGLE TWISTED PAIR, CAT 5 WIRE



WARNING: PHOTOVOLTAIC POWER SOURCE
LABEL 1
ON ALL CONDUITS SPACED AT MAX 10FT

! CAUTION ! SOLAR ELECTRIC SYSTEM CONNECTED AND ENERGIZED
LABEL 2
AT INVERTER

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
LABEL 3
AT INVERTER

PHOTOVOLTAIC DC DISCONNECT
LABEL 4
AT DC DISCONNECT

! WARNING ! ELECTRIC SHOCK HAZARD DO NOT TOUCH TERMINALS TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION
LABEL 5
AT EACH AC DISCONNECT

PHOTOVOLTAIC AC DISCONNECT
LABEL 6
AT EACH AC DISCONNECT

! WARNING ! DUAL POWER SOURCES SECOND SOURCE IS PV SYSTEM
LABEL 7
AT MEP

! WARNING ! SOLAR SYSTEM CONNECTED AND ENERGIZED
LABEL 8
AT MEP

! CAUTION ! SOLAR POINT OF INTERCONNECTION
LABEL 9
AT UTILITY METER

! WARNING ! THE SERVICE METER IS ALSO SERVED BY A PHOTOVOLTAIC SYSTEM
LABEL 10
AT UTILITY METER

	QTY	CONDUCTOR INFORMATION		CONDUIT TYPE	CONDUIT SIZE
1	(4)	#10AWG -	PV WIRE/USE-2	N/A	N/A
	(1)	#6AWG -	BARE COPPER IN FREE AIR		
2	(2)	#10AWG -	THWN-2	EMT OR FLEX IN ATTIC	3/4"
	(1)	#6AWG -	THWN-2 GND		
3	(2)	#10AWG -	THWN-2	EMT OR FLEX	3/4"
	(1)	#10AWG -	THWN-2 GND		
4	(3)	#6AWG -	THWN-2	EMT OR FLEX	3/4"
	(1)	#6AWG -	THWN-2 GND		
5	(3)	#6AWG -	THWN-2	EMT OR FLEX	3/4"
	(1)	#6AWG -	THWN-2 GND		
6	(3)	#6AWG -	THWN-2	EMT OR FLEX	3/4"

1 ELECTRICAL LINE DIAGRAM
PV-4 SCALE: NTS

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REVISIONS

DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS
RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
ELECTRICAL LINE DIAGRAM

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-4

SOLAR MODULE SPECIFICATIONS	
MANUFACTURER / MODEL #	HANWHA QCELL Q.PEAK DUO-G5 320 (320 WATT) MODULES
VMP	33.32V
IMP	9.60A
VOC	40.13V
ISC	10.09A
TEMP. COEFF. VOC	-0.28%/°C
PTC RATING	297W
MODULE DIMENSION	66.3"L x 39.4"W x 1.26"D (In Inch)

INVERTER SPECIFICATIONS	
MANUFACTURER / MODEL #	GENERAC PWRCELL X7602
AC POWER OUTPUT (LOADS/GRID)	7600VA
AC POWER OUTPUT (BACKUP)	8000VA
NOMINAL OUTPUT VOLTAGE	240 VAC
MAX OUTPUT CURRENT @240V (LOADS/GRID)	32A
MAX OUTPUT CURRENT @240V (BACKUP)	50A
NOMINAL DC INPUT VOLTAGE	380Vdc
MAX DC INPUT VOLTAGE	420Vdc
CEC WEIGHTED EFFICIENCY	96.5%
MAX DC POWER (PV)	10000W
MAX INPUT CURRENT (PV)	20Adc
CONT. PEAK POWER (BATTERY)	8000W

SERIES SUB STRING OPTIMIZER SPECIFICATIONS	
MANUFACTURER / MODEL #	PV LINK S2502
RATED POWER	2500W
MPPT VOLTAGE RANGE	60-360 Vmp
MAXIMUM INPUT VOLTAGE	420Voc
MAXIMUM OUTPUT	420 Adc
NOMINAL OUTPUT	380 Vdc
MAXIMUM OUTPUT CURRENT	8 A
MAXIMUM SHORT CIRCUIT CURRENT	18 A

BATTERY SPECIFICATIONS	
MANUFACTURER / MODEL #	GENERAC PWRCELL9 BATTERY
USABLE ENERGY	8.6kW
RATED CONTINUOUS POWER	3.4Kw
POWER: 60 MINUTES	4.2kW
POWER: 2 MINUTES	5.0kW
REBUS VOLTAGE: INPUT/ OUTPUT	360-420Vdc
MODULE VOLTAGE	46.8Vdc
ROUND-TRIP EFFICIENCY	96.5%

AMBIENT TEMPERATURE SPECS	
RECORD LOW TEMP	-10°
AMBIENT TEMP (HIGH TEMP 2%)	35°
CONDUIT HEIGHT	0.5"
ROOF TOP TEMP	57°

DC CONDUCTOR AMPACITY CALCULATIONS:
ARRAY TO JUNCTION BOX:

EXPECTED WIRE TEMP (In Celsius)	57°
TEMP. CORRECTION PER NEC TABLE 310.15 (B)(2)(a)	0.71
NO. OF CURRENT CARRYING CONDUCTORS	4
CONDUIT FILL CORRECTION PER NEC TABLE 310.15(B)(3)(a)	0.8
CIRCUIT CONDUCTOR SIZE	10 AWG
CIRCUIT CONDUCTOR AMPACITY PER NEC TABLE 310.15(B)(16)	40A

REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A&B)	10A
1.25 X Imax	
DERATED AMPACITY OF CIRCUIT CONDUCTOR	22.72A
TEMP. CORRECTION PER TABLE 310.15 (B)(2)(a) X CONDUIT FILL CORRECTION PER NEC 310.15(B)(3)(a) X CIRCUIT CONDUCTOR AMPACITY 310.15 (B)(16)	
Result should be greater than (10A) otherwise less the entry for circuit conductor size and ampacity	

FROM JUNCTION BOX TO INVERTER:

EXPECTED WIRE TEMP (In Celsius)	57°
TEMP. CORRECTION PER NEC TABLE 310.15 (B)(2)(a)	0.71
NO. OF CURRENT CARRYING CONDUCTORS	2
CONDUIT FILL CORRECTION PER NEC TABLE 310.15(B)(3)(a)	1
CIRCUIT CONDUCTOR SIZE	10 AWG
CIRCUIT CONDUCTOR AMPACITY PER NEC TABLE 310.15(B)(16)	40A

REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A&B)	20A
1.25 X Imax X # of PV LINKS	
DERATED AMPACITY OF CIRCUIT CONDUCTOR	28.4A
TEMP. CORRECTION PER TABLE 310.15 (B)(2)(a) X CONDUIT FILL CORRECTION PER NEC 310.15(B)(3)(a) X CIRCUIT CONDUCTOR AMPACITY 310.15 (B)(16)	
Result should be greater than (20A) otherwise less the entry for circuit conductor size and ampacity	

FROM BATTERY TO INVERTER:

EXPECTED WIRE TEMP (In Celsius)	35°
TEMP. CORRECTION PER NEC TABLE 310.15 (B)(2)(a)	0.96
NO. OF CURRENT CARRYING CONDUCTORS	2
CONDUIT FILL CORRECTION PER NEC TABLE 310.15(B)(3)(a)	1
CIRCUIT CONDUCTOR SIZE	10 AWG
CIRCUIT CONDUCTOR AMPACITY PER NEC TABLE310.15(B)(16)	40A

REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A&B)	26.25A
1.25 X Imax	
DERATED AMPACITY OF CIRCUIT CONDUCTOR	38.40A
TEMP. CORRECTION PER TABLE 310.15 (B)(2)(a) X CONDUIT FILL CORRECTION PER NEC 310.15(B)(3)(a) X CIRCUIT CONDUCTOR AMPACITY 310.15 (B)(16)	
Result should be greater than (26.25A) otherwise less the entry for circuit conductor size and ampacity	

AC CONDUCTOR AMPACITY CALCULATIONS:
FROM INVERTER TO BACK-UP PANEL:

No. OF INVERTER	1
EXPECTED WIRE TEMP (In Celsius)	35°
TEMP. CORRECTION PER NEC TABLE 310.15(B)(2)(a)	0.96
NO. OF CURRENT CARRYING CONDUCTORS	3
CONDUIT FILL CORRECTION PER NEC TABLE 310.15(B)(3)(a)	1
CIRCUIT CONDUCTOR SIZE	6 AWG
CIRCUIT CONDUCTOR AMPACITY PER NEC TABLE 310.15(B)(16)	75A

REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A&B)	42.5A
1.25 X INVERTER OUTPUT CURRENT (BACKUP POWER)	
DERATED AMPACITY OF CIRCUIT CONDUCTOR	72A
TEMP. CORRECTION PER TABLE 310.15 (B)(2)(a) X CONDUIT FILL CORRECTION PER NEC 310.15(B)(3)(a) X CIRCUIT CONDUCTOR AMPACITY 310.15 (B)(16)	
Result should be greater than (42.5A) otherwise less the entry for circuit conductor size and ampacity	

AC CONDUCTOR AMPACITY CALCULATIONS:
FROM INVERTER TO MEP:

No. OF INVERTER	1
EXPECTED WIRE TEMP (In Celsius)	35°
TEMP. CORRECTION PER NEC TABLE 310.15(B)(2)(a)	0.96
NO. OF CURRENT CARRYING CONDUCTORS	3
CONDUIT FILL CORRECTION PER NEC TABLE 310.15(B)(3)(a)	1
CIRCUIT CONDUCTOR SIZE	6 AWG
CIRCUIT CONDUCTOR AMPACITY PER NEC TABLE 310.15(B)(16)	75A

REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A&B)	40A
1.25 X MAX INVERTER OUTPUT CURRENT (LOADS/GRID)	
DERATED AMPACITY OF CIRCUIT CONDUCTOR	72A
TEMP. CORRECTION PER TABLE 310.15 (B)(2)(a) X CONDUIT FILL CORRECTION PER NEC 310.15(B)(3)(a) X CIRCUIT CONDUCTOR AMPACITY 310.15 (B)(16)	
Result should be greater than (40A) otherwise less the entry for circuit conductor size and ampacity	

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REVISIONS

DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS
RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
WIRING CALCULATIONS

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-5

Q.PEAK DUO-G5 315-330

Q.ANTUM SOLAR MODULE

The new Q.PEAK DUO-G5 solar module from Q CELLS impresses thanks to innovative Q.ANTUM DUO Technology, which enables particularly high performance on a small surface. Q.ANTUM's world-record-holding cell concept has now been combined with state-of-the-art circuitry half cells and a six-busbar design, thus achieving outstanding performance under real conditions - both with low-intensity solar radiation as well as on hot, clear summer days.

Q.ANTUM TECHNOLOGY: LOW LEVELIZED COST OF ELECTRICITY
Higher yield per surface area, lower BOS costs, higher power classes, and an efficiency rate of up to 19.9%.

INNOVATIVE ALL-WEATHER TECHNOLOGY
Optimal yields, whatever the weather with excellent low-light and temperature behavior.

ENDURING HIGH PERFORMANCE
Long-term yield security with Anti LID and Anti PID Technology[1], Hot-Spot Protect and Traceable Quality Tra.Q™.

EXTREME WEATHER RATING
High-tech aluminum alloy frame, certified for high snow (5400 Pa) and wind loads (4000 Pa) regarding IEC.

A RELIABLE INVESTMENT
Inclusive 12-year product warranty and 25-year linear performance guarantee[2].

STATE OF THE ART MODULE TECHNOLOGY
Q.ANTUM DUO combines cutting edge cell separation and innovative wiring with Q.ANTUM Technology.

THE IDEAL SOLUTION FOR:

Rooftop arrays on residential buildings

Rooftop arrays on commercial/industrial buildings

Engineered in Germany

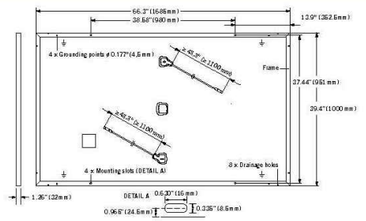
SUPER RESEARCH TOP BRAND PV MODULES 2018

ID. 40032587

[1] APT test conditions according to IEC/TS 62804-1:2015, method B (–1500 V, 168 h)
[2] See data sheet on rear for further information.

MECHANICAL SPECIFICATION

Format	66.3 in × 39.4 in × 1.26 in (including frame) (1685 mm × 1000 mm × 32 mm)
Weight	41.2 lbs (18.7 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 20 monocrystalline Q.ANTUM solar half-cells
Junction box	2.76-3.35 in × 1.97-2.76 in × 0.51-0.83 in (70-85 mm × 50-70 mm × 13-21 mm), decentralized, IP67
Cable	4 mm² Solar cable; (+) ≥ 43.3 in (1100 mm), (–) ≥ 43.3 in (1100 mm)
Connector	Multi-Contact MC4, IP68

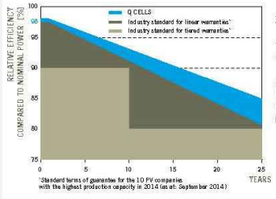


ELECTRICAL CHARACTERISTICS

POWER CLASS			315	320	325	330
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / –0 W)						
Minimum	Power at MPP[1]	P_{MPP} [W]	315	320	325	330
	Short Circuit Current[1]	I_{SC} [A]	10.04	10.09	10.14	10.20
	Open Circuit Voltage[1]	V_{OC} [V]	39.87	40.13	40.40	40.66
	Current at MPP[1]	I_{MPP} [A]	9.55	9.60	9.66	9.71
	Voltage at MPP	V_{MPP} [V]	32.98	33.32	33.65	33.98
	Efficiency[1]	η [%]	≥ 18.7	≥ 19.0	≥ 19.3	≥ 19.6
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]						
Minimum	Power at MPP	P_{MPP} [W]	235.3	239.0	242.8	246.5
	Short Circuit Current	I_{SC} [A]	8.09	8.13	8.17	8.22
	Open Circuit Voltage	V_{OC} [V]	37.52	37.77	38.02	38.27
	Current at MPP	I_{MPP} [A]	7.52	7.56	7.60	7.64
	Voltage at MPP	V_{MPP} [V]	31.30	31.62	31.94	32.25

[1] Measurement tolerances P_{MPP} ±3%; I_{SC}; V_{OC} ±5% at STC: 1000 W/m², 25 ±2 °C, AM 1.5 G according to IEC 60904-3 · [2] 800 W/m², NMOT, spectrum AM 1.5 G

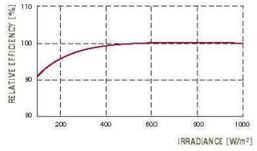
Q CELLS PERFORMANCE WARRANTY



At least 98% of nominal power during first year.
Thereafter max. 0.54% degradation per year.
At least 93.1% of nominal power up to 10 years.
At least 85% of nominal power up to 25 years.

All data within measurement tolerances.
Full warranties in accordance with the warranty terms of the Q CELLS sales organization of your respective country.

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²).

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	–0.28
Temperature Coefficient of P_{MPP}	γ	[%/K]	–0.37	Normal Module Operating Temperature	NMOT	[°F]	109 ±5.4 (43 ±3 °C)

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V_{SYS}	[V]	1000 (IEC) / 1000 (UL)	Safety Class	II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating	C (IEC) / TYPE 1 (UL)
Max. Design Load, push[2]	[lbs/ft²]	75 (3600 Pa) / 55 (2667 Pa)	Permitted module temperature on continuous duty	–40 °F up to +185 °F (–40 °C up to +85 °C)
Max. Test Load, Push / Pull[2]	[lbs/ft²]	113 (5400 Pa) / 84 (4000 Pa)	[2] see installation manual	

QUALIFICATIONS AND CERTIFICATES

UL 1703; VDE Quality Tested; CE-compliant;
IEC 61215:2016; IEC 61730:201, application class A

PACKAGING INFORMATION

Number of Modules per Pallet	32
Number of Pallets per 53' Trailer	30
Number of Pallets per 40' High Cube Container	26
Pallet Dimensions (L × W × H)	69.3 in × 45.3 in × 46.9 in (1760 mm × 1150 mm × 1190 mm)
Pallet Weight	1415 lbs (642 kg)

NOTE: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.
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Web: www.powerhome.com

REVISIONS

DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-6

FEATURES:

No autotransformer or battery inverter needed

User-selectable modes

Free system monitoring

GENERAC

PWRCELL

Inverter
Model: X7602, X11402

Solar-plus-storage is simple with the Generac PWRcell Inverter. This bi-directional, REbus™-powered inverter offers a simple, efficient design for integrating smart batteries with solar. Ideal for self-supply, backup power, zero-export and energy cost management, the PWRcell inverter is the industry's most feature-rich line of inverters, available in single-phase and three-phase models.

ADDITIONAL FEATURES

- Single inverter for grid-tied solar with smart battery integration
- Simplified system design: No autotransformer or battery inverter needed
- User-selectable modes for backup power, self-supply, time-of-use and zero-export
- Free system monitoring included via PWRview Web Portal and Mobile App

AC OUTPUT/ GRID-TIE	MODEL X7602	MODEL X11402
RATED AC POWER OUTPUT	7600 W	11400 W
AC OUTPUT VOLTAGE	120/240, 1Ø VAC	120/208, 3Ø VAC
AC FREQUENCY	60 Hz	60 Hz
MAXIMUM CONTINUOUS OUTPUT CURRENT	32 A, RMS	32 A, RMS
GROUND-FAULT ISOLATION DETECTION	Included	Included
CHARGE BATTERY FROM AC	Yes	Yes
THD (CURRENT)	< 2 %	< 2 %
TYPICAL NIGHTTIME POWER CONSUMPTION	< 7 W	< 7 W

AC OUTPUT/ BACKUP	MODEL X7602	MODEL X11402
RATED AC BACKUP POWER OUTPUT	8000 W	8000 W
MAXIMUM AC BACKUP POWER OUTPUT	12000 W	12000 W
AC BACKUP OUTPUT VOLTAGE	120/240, 1Ø VAC	120/240, 1Ø VAC
AC FREQUENCY	60 HZ	60 HZ
AC CIRCUIT BREAKER	50 A	50 A
THD (VOLTAGE)	< 2 %	< 2 %
AUTOMATIC SWITCHOVER TIME	< 1 Seconds	< 1 Seconds
TYPICAL NIGHTTIME POWER CONSUMPTION	30 W	30 W

DC INPUT	MODEL X7602	MODEL X11402
DC INPUT VOLTAGE RANGE	360-420 VDC	360-420 VDC
NOMINAL DC BUS VOLTAGE	380 VDC	380 VDC
MAX INPUT CURRENT	20 A	30 A
REVERSE-POLARITY PROTECTION	YES	YES
GROUND-FAULT ISOLATION DETECTION	YES	YES
TRANSFORMERLESS, UNGROUNDED	YES	YES

DC INPUT/ BATTERY	MODEL X7602	MODEL X11402
MAXIMUM CONTINUOUS POWER	8000 W	8000 W
INTERNAL DC DISTRIBUTION BREAKERS	4X 2P30A	4X 2P30A
DC FUSES ON PLUS AND MINUS	40 A	40 A
2-POLE DISCONNECTION	YES	YES

EFFICIENCY	MODEL X7602	MODEL X11402
PEAK EFFCIENCY	97 %	98 %
CEC WEIGHTED EFFCIENCY	96.5 %	97.5 %

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Specifications

FEATURES AND MODES	
ISLANDING[3]	Yes
GRID SELL	Yes
SELF CONSUMPTION	Yes
PRIORITIZED CHARGING FROM RENEWABLES	Yes
GRID SUPPORT - ZERO EXPORT	Yes

ADDITIONAL FEATURES	
SUPPORTED COMMUNICATION INTERFACES	CANbus, RS4854, Ethernet
SYSTEM MONITORING	PWRview Web Portal and Mobile App
CRITICAL LOADS DISCONNECT[3]	Yes
MANUAL INVERTER BYPASS SWITCH	Automatic
WARRANTY	10 Years

STANDARDS COMPLIANCE	
SAFETY	UL1741 SA, CSA 22.2
GRID CONNECTION STANDARDS	IEEE1547, Rule 21, Rule 14H
EMISSIONS	FCC part15 class B

DIMENSIONS AND INSTALLATION SPECIFICATIONS	
WIRE GAUGE RANGE	10 - 8 AWG
TOTAL AC KNOCKOUTS X SIZE	2" x 0.75", 2 x 1"
TOTAL DC KNOCKOUTS X SIZE	5" x 1"
DIMENSIONS (L,W,H)	24.5" x 19.25" x 8"
WEIGHT	62.7 lb
COOLING	Forced convection
NOISE	< 40 dBA
OPERATING TEMPERATURE	-20 to 50 °C*
PROTECTION RATING	NEMA 3R

INSTALLATION GUIDELINES	
BATTERY TYPES SUPPORTED	PWRcell battery module
MODULE STRING SIZE PER PV LINK OPTIMIZER	2-9 PV modules
MAXIMUM RECOMMENDED DC POWER FROM PV	10kW (1Ø), 15kW (3Ø)
BATTERIES PER INVERTER	Up to 2

[3] 3Ø inverters offer islanding for 1Ø loads, [4] Modbus,
*Reduced power at extreme temperatures

*Specifications subject to change without notice.

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DATE: 5/20/2020

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TIMOTHY M WILLIAMS RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-7

FEATURES:

Easy installation

Low cost, high efficiency solution

NEC 2017 and 2020 PVRSS compliant

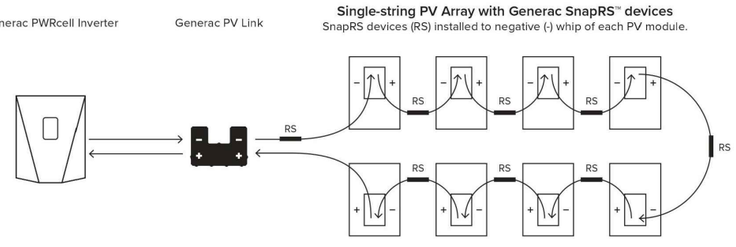
SnapRS™

Instant Rapid Shutdown Compliance
Model: RS801

The Generac SnapRS is NEC 2017 compliant, and doesn't require any extra hardware to mount, no pairing and no fussy digital communications. Just snap a Generac SnapRS disconnect device to each PV module for total rapidshutdown performance. When signaled by the inverter, SnapRS units break the PV circuit, reducing array voltage to <80V in seconds.

SYSTEM DESIGN

Snap a Generac SnapRS disconnect device to the negative whip (-) of each module in the solar array for simple NEC-2017 module-level rapid shutdown compliance. SnapRS devices isolate array voltage when a rapid shutdown command is given by a connected Islanding Inverter



ADDITIONAL FEATURES

- Fast, easy and simple to install
- One SnapRS device per PV module
- Achieves PVRSS Compliance
- Low cost, high efficiency solution

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Specifications

SNAPRS (RS801)

PV MODULE MAX VOC	75 V	OPERATING TEMPERATURE	-40 to 70 °C
EFFICIENCY	99.9 %	CERTIFICATIONS	UL1741
MAX INPUT CURRENT	13 A	WEIGHT	100 g
SHUTDOWN TIME	< 10 Seconds	DIMENSIONS (L,W,H)	1" x 1" x 7"
ENCLOSURE RATING	NEMA 6P	WARRANTY	25 Years

Specifications subject to change without notice.

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SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-8

FEATURES:

Connect up to 2 PWRcells to a single PWRcell Inverter

Plug-and-play with PWRcell Inverters and PV Links

Residential and commercial application ready

GENERAC

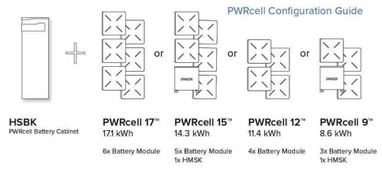
PWRCELL

Battery
Model: 9, 12, 15, 17

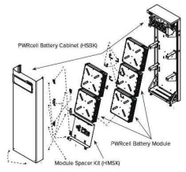
No other smart battery offers the flexibility of PWRcell. Whether for backup power or smart energy management, the PWRcell battery has power and capacity options for every need, without sacrificing flexibility or function.

The PWRcell battery series allows system owners the flexibility to scale from the economical 8.6kWh PWRcell 9™ to the massive 17.1 kWh PWRcell 17™ by adding additional PWRcell battery modules, the gold standard in storage.

PWRCELL CONFIGURATION GUIDE



PWRCELL ASSEMBLY



PWRCELL BATTERY DESIGN

PWRcell is a modular smart battery platform that allows for a range of configurations to suit any need, small or large. PWRcell can be built in capacities ranging from 8.6-17.1kWh. When needs change, PWRcell can be upgraded with additional modules. Use the chart above to understand what components you need for your chosen PWRcell configuration.

ADDITIONAL FEATURES

- Connect as many as two 2 PWRcells to a single PWRcell Inverter™ for up to 34.2kWh of storage
- Best-in-class battery backup power
- Plug-and-play with PWRcell Inverters™ and PV Links™
- Time-of-use (TOU) and zero-export ready
- Residential and commercial application ready

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Specifications

PWRCELL MODEL	9	12	15	17
BATTERY MODULES	3	4	5	6
USABLE ENERGY	8.6 kWh	11.4 kWh	14.3 kWh	17.1 kWh
POWER: RATED CONTINUOUS	3.4 kW	4.5 kW	5.6 kW	6.7 kW
POWER: 60 MINUTES	4.2 kW	5.6 kW	7.0 kW	8.4 kW
POWER: 2 MINUTES	5.0 kW	6.7 kW	8.4 kW	10.0 kW
REBUS VOLTAGE: INPUT/OUTPUT	360-420 VDC			
MODULE VOLTAGE	46.8 VDC			
ROUND-TRIP EFFICIENCY	96.5 %			
OPERATING TEMPERATURE	-10 to 45 °C*			
RECOMMENDED TEMPERATURE	13 to 30 °C			
MAXIMUM INSTALLATION ALTITUDE	9834 ft, (3000 m)			
DIMENSIONS (L,W,H)	68" x 22" x 10"			
WEIGHT (ENCLOSURE)	115 lb, (52 kg)			
WEIGHT (INSTALLED)	280 lb, (127 kg)	335 lb, (152 kg)	390 lb, (178 kg)	445 lb, (202 kg)
WARRANTY: LI-ION MODULES	10 Years, (22.6 MWh)	10 Years, (30.2 MWh)	10 Years, (37.8 MWh)	10 Years, (45.3 MWh)
WARRANTY: ELECTRONICS AND ENCLOSURE	10 Years			
COMMUNICATION PROTOCOL	REbus DC Nanogrid™			
COMPLIANCE	UL 9540, UL 1973, UL 1642, CSA 22.2			

*Reduced power at extreme temperatures

Specifications subject to change without notice.

UPGRADING PWRCELL

Inside of the PWRcell battery, the PWRcell battery modules are stacked 2-deep on three levels, allowing for up to six modules to be connected in series. Upgrade an existing PWRcell battery by adding modules and a module spacer (HMSK) if required. PWRcell 9 and PWRcell 15 require a module spacer.

Generac offers a convenient PWRcell Battery Upgrade Kit (HMUK) to help replace lost or misplaced hardware. A PWRcell Battery Upgrade Kit may be purchased from your Generac distributor.

Refer to the table to the right for material requirements related to upgrading PWRcell.

UPGRADE MATERIAL REQUIREMENTS

Starting Configuration \ Ending Configuration	PWRCELL 17	PWRCELL 15	PWRCELL 12
PWRCELL 9	+ 3 x PWRCell Mod + 2 x HMUK*	+ 2 x PWRCell Mod + 1 x HMUK*	+ 1 x PWRCell Mod + 1 x HMUK*
PWRCELL 12	+ 2 x PWRCell Mod + 1 x HMUK*	+ 1 x PWRCell Mod + 1 x HMSK	
PWRCELL 15	+ 1 x PWRCell Mod + 1 x HMUK*		

*HMUK (Upgrade kit) only required if original hardware is unavailable

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PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS
RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-9

FEATURES:

Fast, simple installation

Lower failure risk than module-level optimizers

NEC 2017 rapid shutdown compliant with SnapRS™

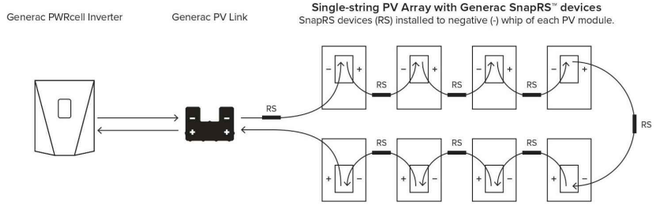
PV Link™

S2500 Series substring optimizer
Model: S2502

PV Link is the simple solar optimizer for quick installation and long-lasting performance. Connect as few as two or as many as nine PV modules to each PV Link to overcome shading and challenging roof lines.

ADDITIONAL FEATURES

- Quick connections with MC4 connectors
- 2500W capacity
- Compatible with high-voltage smart batteries
- Cost-effective solution for high-performance PV
- Ground-fault protection



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Specifications

PWRCELL PV LINK (S2502)

RATED POWER	2500 W
PEAK EFFICIENCY	99%
MPPT VOLTAGE RANGE	60-360 VMP
MAX INPUT VOLTAGE	420 VOC; max when cold
MAX OUTPUT	420 VOC
NOMINAL OUTPUT (REBUS™)	380 VDC
MAX OUTPUT CURRENT	8 A
MAX SHORT CIRCUIT CURRENT (ISC)	18 A
STANDBY POWER	< 1 W

PROTECTIONS	Ground-fault, Arc-fault (Arc-fault Type 1 AFCI, Integrated)
MAX OPERATING TEMP	70 °C
SYSTEM MONITORING	PWRview Web Portal and Mobile App
ENCLOSURE	Type 3R
WEIGHT	7.3 lb
DIMENSIONS (L,W,H)	2" x 15.4" x 9.6"
COMPLIANCE	UL 1741, CSA 22.2
WARRANTY	25 Years

Specifications subject to change without notice.

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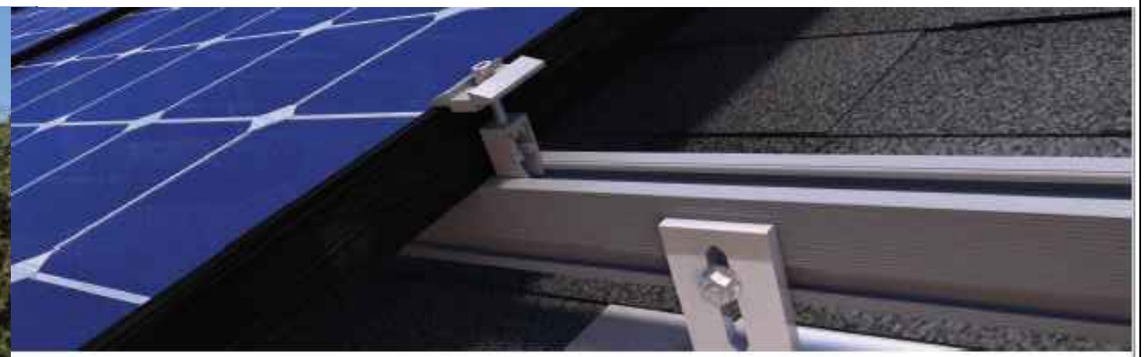
SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-10



QRail™— Fully Integrated Mounting and Racking System

The QRail Series is a strong and versatile solar array mounting system that provides unrivaled benefits to solar designers and installers. Combined with Quick Mount PV's industry-leading waterproof mounts, QRail offers a complete racking solution for mounting solar modules on any roof.

Easily design array configurations with the QDesign software application. Generate complete engineering reports and calculate a precise bill of materials for all the mounting, racking and accessories needed for a complete solar array.

Comprehensive, One-Source Solution

QRail, together with Quick Mount PV's waterproof mounting products, provides the benefit of a single-sourced, seamlessly integrated rooftop installation that works with all roof types — composition/asphalt shingles, flat or curved tile, metal shingle, shake, slate and low slope roofs. The QRail system also works with any roof attachment system for maximum flexibility.

Superior Strength and Versatility

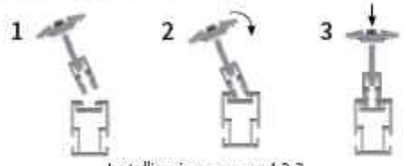
QRail is engineered for optimal structural performance. The system is certified to UL 2703, fully code compliant and backed by a 25-year warranty. QRail is available in Light, Standard and Heavy versions to match all geographic locations. QRail is compatible with virtually all modules and works on a wide range of pitched roof surfaces. Modules can be mounted in portrait or landscape orientation in standard or shared-rail configurations.

QRails come in two lengths — 168 inches (14 ft) and 208 inches (17.3 ft) Mill and Black Finish

Fast, Simple Installation: It Just Clicks

QClick Technology™

The universal mid and end clamps use QClick technology to simply "click" into the rail channel and remain upright, ready to accept the module. The pre-assembled clamps fit virtually all module frames and require no extra hardware, eliminating pre-loading and reducing installation time.



Installing is as easy as 1-2-3

Universal End Clamp

2 clamps for modules from 30-45mm or 38-50mm thick

Universal Bonded Mid Clamp

2 clamps for modules from 30-45mm or 38-50mm thick

QSplice™ Technology

QRail's innovative internal QSplice installs in seconds, requiring no tools or screws. Simply insert QSplice into the rail and slide the other rail on to create a fully structural, bonded splice. An external splice is also available.

Installs in seconds — no tools or hardware required

Fully Integrated Electrical Bonding

The QRail system provides an integrated electrical bonding path, ensuring that all exposed metal parts and the solar module frames are electrically connected. All electrical bonds are created when the components are installed and tightened down.

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BUNNLEVEL, NC 28323

SHEET NAME
EQUIPMENT SPECIFICATION

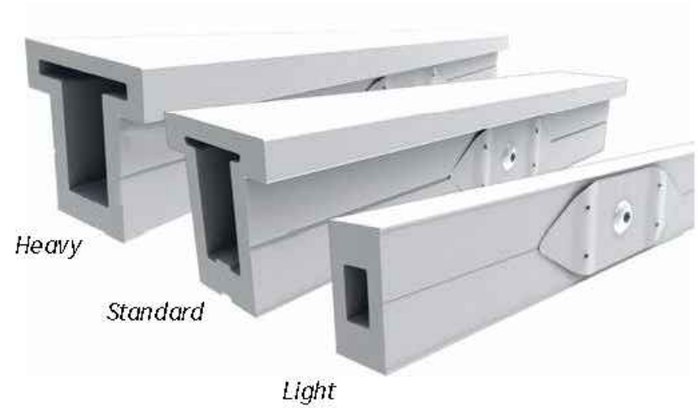
SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-11

QRail™ Configurations

Item Code	Part Number	Description	Finish
QMR-RL14A60	800	QRail Light, 14 ft., 60 Pack	Mill
QMR-RL17.3A60	801	QRail Light, 17.3 ft, 60 Pack	Mill
QMR-RL14B60	805	QRail Light, 14 ft., 60 Pack	Black
QMR-RL17.3B60	806	QRail Light, 17.3 ft, 60 Pack	Black
QMR-RS14A60	810	QRail Standard, 14 ft., 60 Pack	Mill
QMR-RS17.3A60	811	QRail Standard, 17.3 ft, 60 Pack	Mill
QMR-RS14B60	815	QRail Standard, 14 ft., 60 Pack	Black
QMR-RS17.3B60	816	QRail Standard, 17.3 ft, 60 Pack	Black
QMR-RH14A60	820	QRail Heavy, 14 ft., 60 Pack	Mill
QMR-RH17.3A60	821	QRail Heavy, 17.3 ft, 60 Pack	Mill
QMR-RH14B60	825	QRail Heavy, 14 ft, 60 Pack	Black
QMR-RH17.3B60	826	QRail Heavy, 17.3 ft, 60 Pack	Black

QSplice™ Internal Structural Splice



Item Code	Part Number	Description	Finish
QMR-ISLA15	830	QSplice Internal, Light, 15 Pack	Mill
QMR-ISSA15	831	QSplice Internal, Standard, 15 Pack	Mill
QMR-ISHA15	832	QSplice Internal, Heavy, 15 Pack	Mill

QSplice™ External Structural Splice

Item Code	Part Number	Description	Finish
QMR-ESSA15	834	QSplice External, Standard, 15 Pack	Mill
QMR-ESHA15	835	QSplice External, Heavy, 15 Pack	Mill

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SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-11A

Universal End Clamp with QClick™ Technology

Black *Mill*

Item Code	Part Number	Description	Finish
QMR-UEC3045A20	860	Universal End Clamp, 30-45mm, 20 Pack	Mill
QMR-UEC3850A20	861	Universal End Clamp, 38-50mm, 20 Pack	Mill
QMR-UEC3045B20	865	Universal End Clamp, 30-45mm, 20 Pack	Black
QMR-UEC3850B20	866	Universal End Clamp, 38-50mm, 20 Pack	Black
QMR-UEC3045BPA20	862	Universal End Clamp, 30-45mm, w/ Bonding, 20 Pack	Mill
QMR-UEC3850BPA20	863	Universal End Clamp, 38-50mm, w/ Bonding, 20 Pack	Mill
QMR-UEC3045BPB20	867	Universal End Clamp, 30-45mm, w/ Bonding, 20 Pack	Black
QMR-UEC3850BPB20	868	Universal End Clamp, 38-50mm, w/ Bonding, 20 Pack	Black

Mid Clamp with QClick™ Technology

Black *Mill*

Item Code	Part Number	Description	Finish
QMR-UMC3045BP1.2A20	872	Universal Mid Clamp, 30-45mm, w/ Bonding, 20 Pack	Mill
QMR-UMC3850BP1.2A20	873	Universal Mid Clamp, 38-50mm, w/ Bonding, 20 Pack	Mill
QMR-UMC3045BP1.2B20	877	Universal Mid Clamp, 30-45mm, w/ Bonding, 20 Pack	Black
QMR-UMC3850BP1.2B20	878	Universal Mid Clamp, 38-50mm, w/ Bonding, 20 Pack	Black

Single-Slot L-Foot

Item Code	Part Number	Description	Finish
QMC-LF A12	692	Single-slot L-foot, 12 Pack	Mill
QMC-LF B12	693	Single-slot L-foot, 12 Pack	Black

End Caps

Heavy *Standard* *Light*

Item Code	Part Number	Description	Finish
QMR-CPL B50	885	End Cap Light, 50 Pack	Black
QMR-CPS B50	886	End Cap Standard, 50 Pack	Black
QMR-CPH B50	887	End Cap Heavy, 50 Pack	Black

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Web: www.powerhome.com

REVISIONS

DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-11B

T-Bolt

Item Code	Part Number	Description	Finish
QMR-TB A 300	880	T-Bolt w/ Nut, 300 Pack	stainless steel

Wire Clip

Works with both PV and Trunk Cabling

Item Code	Part Number	Description	Finish
QMR-WC A 300	882	Trunk/PV Cable, 300 Pack	stainless steel

Grounding Lug

Item Code	Part Number	Description	Finish
QMR-GL A 50	890	WEEB Lug w/ T-Bolt, 50 Pack	n/a

WEEB BMC

Item Code	Part Number	Description	Finish
QMR-ECW A 50	891	WEEB BMC, 50 Pack	stainless steel

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BUNNLEVEL, NC 28323

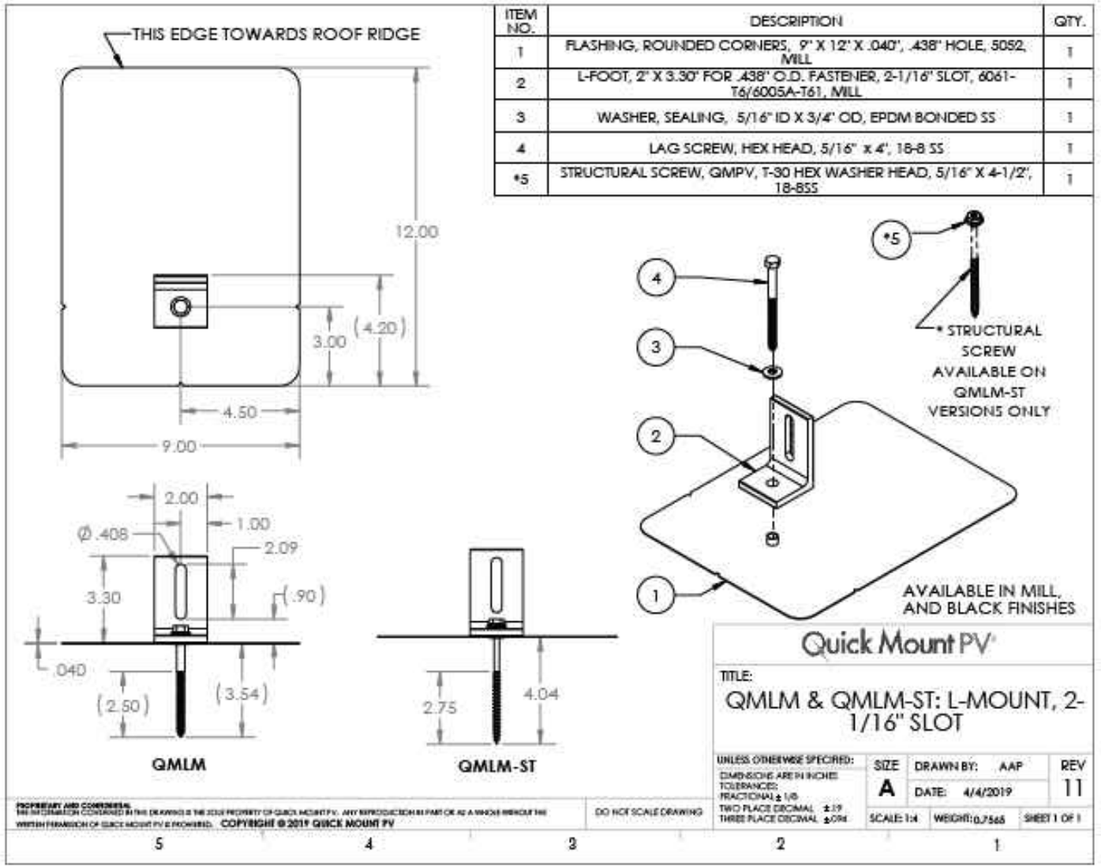
SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-11C

L-Mount | QMLM / QMLM-ST

Elevated Water Seal Technology®



ITEM NO.	DESCRIPTION	QTY.
1	FLASHING, ROUNDED CORNERS, 9" X 12" X .040", .438" HOLE, 5052, MILL	1
2	L-FOOT, 2" X 3.30" FOR .438" O.D. FASTENER, 2-1/16" SLOT, 6061-T6/6005A-T61, MILL	1
3	WASHER, SEALING, .5/16" ID X 3/4" OD, EPDM BONDED SS	1
4	LAG SCREW, HEX HEAD, 5/16" x 4", 18-8 SS	1
*5	STRUCTURAL SCREW, QMPV, T-30 HEX WASHER HEAD, 5/16" X 4-1/2", 18-8SS	1

Quick Mount PV

TITLE: QMLM & QMLM-ST: L-MOUNT, 2-1/16" SLOT

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES: FRACTIONAL ± 1/8, TWO PLACE DECIMAL ±.19, THREE PLACE DECIMAL ±.094

SIZE A | DRAWN BY: AAP | DATE: 4/4/2019 | REV 11 | SCALE: 1:4 | WEIGHT: 0.7565 | SHEET 1 OF 1

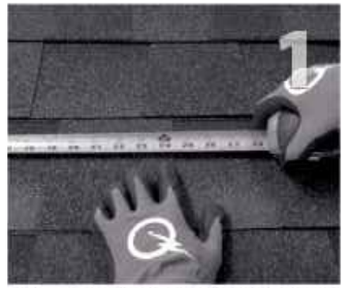
5 4 3 2 1

Quick Mount PV®
RESPECT THE ROOF

L-Mount Installation Instructions

Installation Tools Required: tape measure, roofing bar, chalk line, stud finder, caulking gun, sealant compatible with roofing materials, drill with 7/32" or 1/8" bit, drill or impact gun with 1/2" socket.

WARNING: Quick Mount PV products are NOT designed for and should NOT be used to anchor fall protection equipment.



Locate, choose, and mark centers of rafters to be mounted. Select the courses of shingles where mounts will be placed.

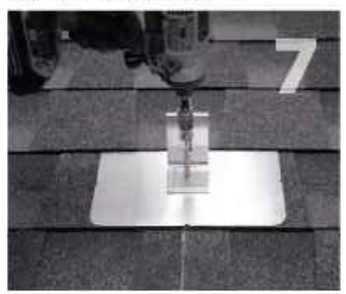
Carefully lift composition roof shingle with roofing bar, just above placement of mount. Remove nails as required and backfill holes with aproved sealant. See "Proper Flashing Placement" on next page.

Insert flashing between 1st and 2nd course. Slide up so top edge of flashing is at least ¾" higher than the butt-edge of the 3rd course and lower flashing edge is above the butt-edge of 1st course. Mark center for drilling.

If attaching with lag bolt use a 7/32" bit (Lag). Use a ⅛" bit (ST) for attaching with the structural screw. Drill pilot hole into roof and rafter, taking care to drill square to the roof. Do not use mount as a drill guide. Drill a 2" deep hole into rafter.

Clean off any sawdust, and fill hole with sealant compatible with roofing materials.

Place L-foot onto elevated flute and rotate L-foot to desired orientation.



Prepare lag bolt or structural screw with sealing washer. Using a ½-inch socket on an impact gun, drive prepared lag bolt through L-foot until L-foot can no longer easily rotate. **DO NOT over-torque.** NOTE: Structural screw can be driven with T-30 hex head bit.

BI 7.2.3-44

You are now ready for the rack of your choice. Follow all the directions of the rack manufacturer as well as the module manufacturer. NOTE: Make sure top of L-Foot makes solid contact with racking.

All roofing manufacturers' written instructions must also be followed by anyone modifying a roof system. Consult the roof manufacturer's specs and instructions prior to working on the roof.

Apr-2019 Rev 6

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REVISIONS

DESCRIPTION	DATE	REV

Signature with Seal

DATE: 5/20/2020

PROJECT NAME & ADDRESS

TIMOTHY M WILLIAMS RESIDENCE
138 TACTICAL DR.,
BUNNLEVEL, NC 28323

SHEET NAME
EQUIPMENT SPECIFICATION

SHEET SIZE
ANSI B
11" X 17"

SHEET NUMBER
PV-12

May 18, 2020

Power Home Solar and Roofing
919 North Main Street
Mooresville, NC 28115

Design Criteria:
Ultimate Wind Speed- 120 mph
Ground Snow Load- 10 psf
Risk Category- II
Exposure category- C

RE: Structural Roof Evaluation for the ***Williams Residence: 138 Tactical Drive, Bunnlevel, North Carolina***

As per your request, we have evaluated the roof structure under the proposed solar panel array. The information used to evaluate this structure was gathered during a field visit by Power Home Solar and Roofing on behalf of Right Angle Engineering. The roof structure consists of pre-manufactured trusses spaced at 24" on center. The roof material consists of asphalt shingles. The design criteria used to analyze this structure are listed above and included with this letter. The adopted building codes in this jurisdiction are: *the 2018 North Carolina Building Code, the 2018 North Carolina Existing Building Code,* and *ASCE 7-16*.

North Carolina Existing Building Code (NCEBC) 2018 section 807.4 indicates that alterations to an existing building that results in less than a 10% increase in the total stress may be performed without a structural evaluation of the existing building. As demonstrated in the attached calculations, the additional weight of the solar panels will be less than 10% increase in the gravity loading and the stress on the existing roof framing.

Based on our assessment we have determined that the existing roof framing will safely and adequately support the additional loads imposed by the solar panels. In order for the loads to be evenly distributed, the roof attachments should be staggered and spread evenly throughout the panel array. Attachment points should be spaced at a maximum of 48" on center. The racking system should be installed per the manufacture's specifications. There should be a minimum of 27 L-foot attachment points to the roof. Each attachment should have a 5/16" or 18/8 SS lag screw with 2.5" minimum penetration centered on each truss top chord. Waterproofing around the roof penetrations is the responsibility of others. Right Angle Engineering assumes no responsibility for improper installation of the solar panels.

Regards,

5/18/20

Robert D Smythe, P.E.
Right Angle Engineering

55 WEST 500 SOUTH, HEBER CITY, UT 84032
T 925.787.3067 U RIGHTANGLEENG.COM

RIGHT ANGLE ENGINEERING

Design Criteria:

Design Wind Speed (3 second gust)	120	mph
Exposure Category	C	
Risk Category	2	
Mean Roof Height	30	ft
Roof Type	Gable Roof	
Building Type	enclosed	

Roof Dead Load- ASCE Table C3-1

Asphalt Shingles	2	psf
3/8" Plywood Sheathing	1.2	psf
Roof Framing	4	psf
Insulation	3.85	psf
Gypsum sheathing	2	psf
Solar Panel Array	3	psf
Dead Load Without Panels	13.05	psf
Dead Load With Solar panels	16.05	psf

Roof Live Load

Existing Roof Live Load	20	psf	ASCE 7-16 Table 4.3-1
Roof Live Load with Solar Panels	0	psf	2018 NCBC 1607.12.5

Roof Snow Load-ASCE 7-16

Ground Snow Load (pg)	10	psf	Section 7.2
Exposure Factor (Ce)	0.9		Table 7.3-1
Thermal Factor (Ct)	1.1		Table 7.3-2
Importance Factor (Is)	1		Table 1.5-2
Flat Roof Snow Load (Pf)	7		Equation 7.3-1
Slippery surface Slope Factor (Cs)	0.6		Figure 7-2
Nonslippery Surface Slope Factor (Cs)	1		Figure 7-2
Roof Snow Load	7	psf	Equation 7.4-1
Reduced Roof Snow Load (Slippery Surface)	4	psf	Equation 7.4-1

Load Combinations - ASCE 7-16 Section 2.4.1

	Without Solar Panels	With Solar panels
D + Lr	33 psf	16 psf
D + S	20 psf	20.2 psf

RIGHT ANGLE ENGINEERING

Solar Array 1-

Roof Slope	34	degrees
Number of panels	13	
Panel Area	227.5	ft^2

Wind Calculations- ASCE 7-16

GC_p Zone 1	-1		Figure 30.3-(2A-5B)
GC_p Zone 2	-1.2		Figure 30.3-(2A-5B)
GC_p Zone 3	-1.2		Figure 30.3-(2A-5B)
Gcpi	0.18		Table 26.13-1
Velocity Pressure (q_h)	30.7	psf	
$q_h = .00256K_hK_{ht}K_dV^2$			Equation 26.10-1
K_h	0.98		Table 26.10-1
K_{ht}	1		Equation 26.8-1
K_d	0.85		Table 26.6-1
Designed wind pressure (P)		psf	Equation 30.8-1
$P= q_h(GC_h) - (GC_{hi})$			
Zone 1 Pressure (P)	-36.2	psf	
Zone 2 Pressure (P)	-42.4	psf	
Zone 3 Pressure (P)	-42.4	psf	

Roof Connection

Shear Capacity	190	lbs	NDS 2015 Table 12K
Shear tributary area	47.5	ft^2	
Pullout Capacity	266	lbs/in	
Lag screw embedment	2.5	in	
Total pullout capacity	665	lbs	NDS 2015 Table 12.2A
Pullout max tributary area	15.7	ft^2	
Factor of Safety	2.31		
Minimum number of connections	**27**		

Beam Stress NCEBC 2018 Section 806.2

Beam Span	14	ft
Spacing	2	ft
Roof Framing type	pre-manufactured trusses	
Panel Orientation	portrait	
Number of Panels per rafter	2	
Panel distance from eave	1	

	Without Solar Panels	With Solar Panels	Percent Increase	
Bending Moment	1619.4 ft-lbs	647.5 ft-lbs	40%	Less than 105%
Vertical Reaction (V1)	462.7 lbs	279.8 lbs	60.5%	Less than 105%
Vertical Reaction (V2)	462.7 lbs	252.1 lbs	54.5%	Less than 105%