SCOPE OF WORK

TO INSTALL A RESIDENTIAL ROOFTOP SOLAR PHOTOVOLTAIC (PV) SYSTEM WITH BATTERY BACKUP. THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT. THE PV SYSTEM INCLUDES 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

NCDOI REQUIREMENTS

OPTION 2

WEIGHT OF PV SYSTEM ON ROOF:

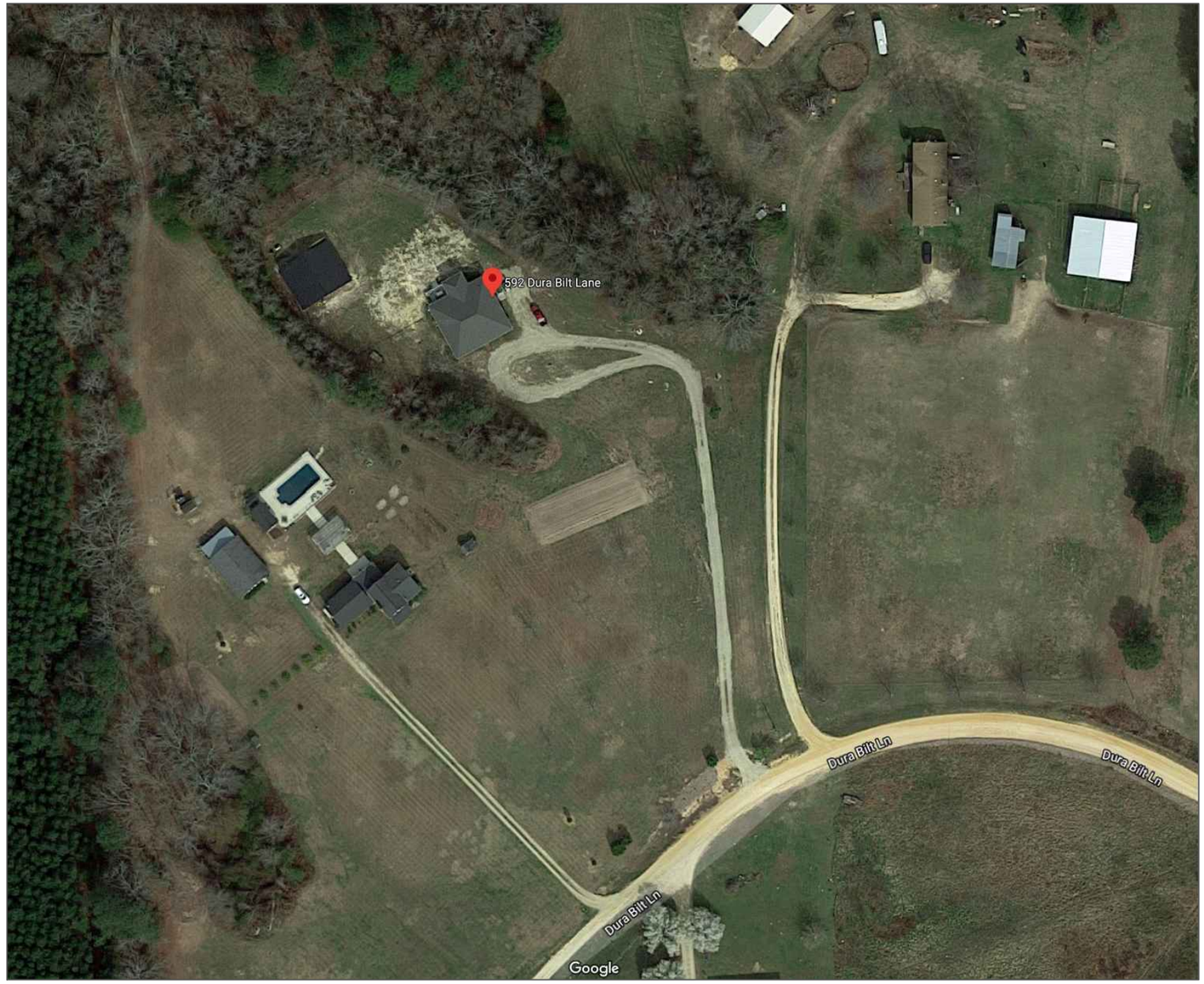
2.6252 PSF

EXISTING ROOF MATERIAL TYPE:

ASPHALT SHINGLES (SINGLE LAYER)

PROJECT LOCATION WIND ZONE:

115 MPH



VICINITY MAP

NOTICE TO CONTRACTOR
All construction must comply with current NC Building Codes and is subject to inspection and verification.
APPROVED
Limited building only review
Permit holder responsible for full compliance with the code
09/01/2020
Harnett COUNTY NORTH CAROLINA

SHEET INDEX	
COVER	GENERAL INFORMATION
PV-1	SITE PLAN
PV-2	ROOF LAYOUT AND MOUNTING DETAIL
PV-3	ELECTRICAL SCHEMATIC
PV-4	AMPACITY CALCULATIONS AND WIRE SIZING
PV-5	LABELING SCHEDULE
CUTSHEETS	MANUFACTURER SPECIFICATION SHEETS

GOVERNING CODES
NFPA 70 NATIONAL ELECTRICAL CODE 2017
2018 INTERNATIONAL BUILDING CODE
2018 NORTH CAROLINA BUILDING CODE
2018 NORTH CAROLINA RESIDENTIAL CODE
UNDERWRITERS LABORATORIES (UL) STANDARDS
OSHA 29 CFR 1910.269
NORTH CAROLINA DEPARTMENT OF INSURANCE

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 PROGRESS
AHJ	TOWN OF MORRISVILLE

SYSTEM SPECIFICATIONS	
SOLAR MODULES	(32) SILFAB SIL-320NL 320 WATT MODULES
POWER OPTIMIZERS	(32) SMA TS4-R-F
INVERTER(S)	(2) SMA SB6.0-1SP-US-41
SOLAR MOUNTS	QUICKMOUNT PV L-MOUNTS
SOLAR RACKING SYSTEM	EVEREST CROSSRAIL X48
MONITORING	YES
POINT OF INTERCONNECT	60A/2P BREAKER IN MSP

CONTRACTOR

SUN DOLLAR ENERGY, LLC
4904 ELAINE AVENUE
RALEIGH, NC 27616
(919) 508-6907
NC ELE LICENSE #: 30043U
NC GC LICENSE #: 73462

PROJECT & CLIENT INFORMATION

MEREDITH RESIDENCE
NEW SOLAR PV SYSTEM
SYSTEM SIZE: 10.24 KW DC
SYSTEM SIZE: 12.0 KW AC

DANA MEREDITH
592 DURA BILT LN
COATS, NC 27521
(910) 987-5108

ENGINEER OF RECORD

DRAWING BY

GBR

REVISIONS

DESCRIPTION	DATE	#	BY
RELEASED FOR PERMITTING	8/19/2020	1	GBR

SHEET SIZE

ANSI B
11" X 17"

DATE

8/19/2020

SHEET NAME

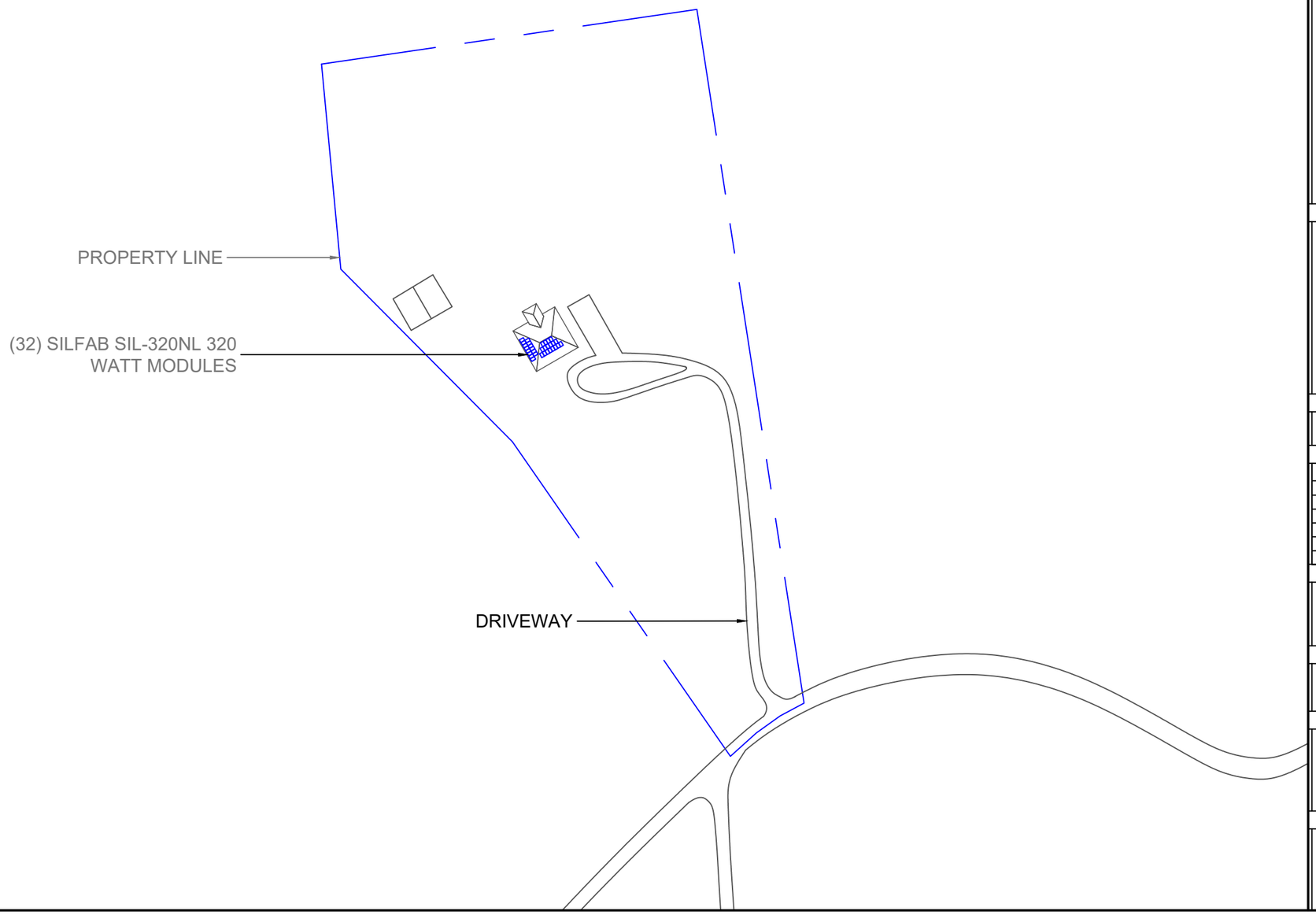
GENERAL INFORMATION

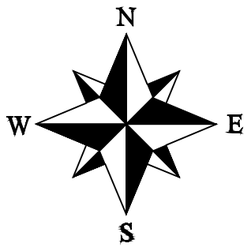
SHEET NUMBER

COVER

PROPERTY PLAN

SCALE: 1/128"=1'-0"





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SITE PLAN

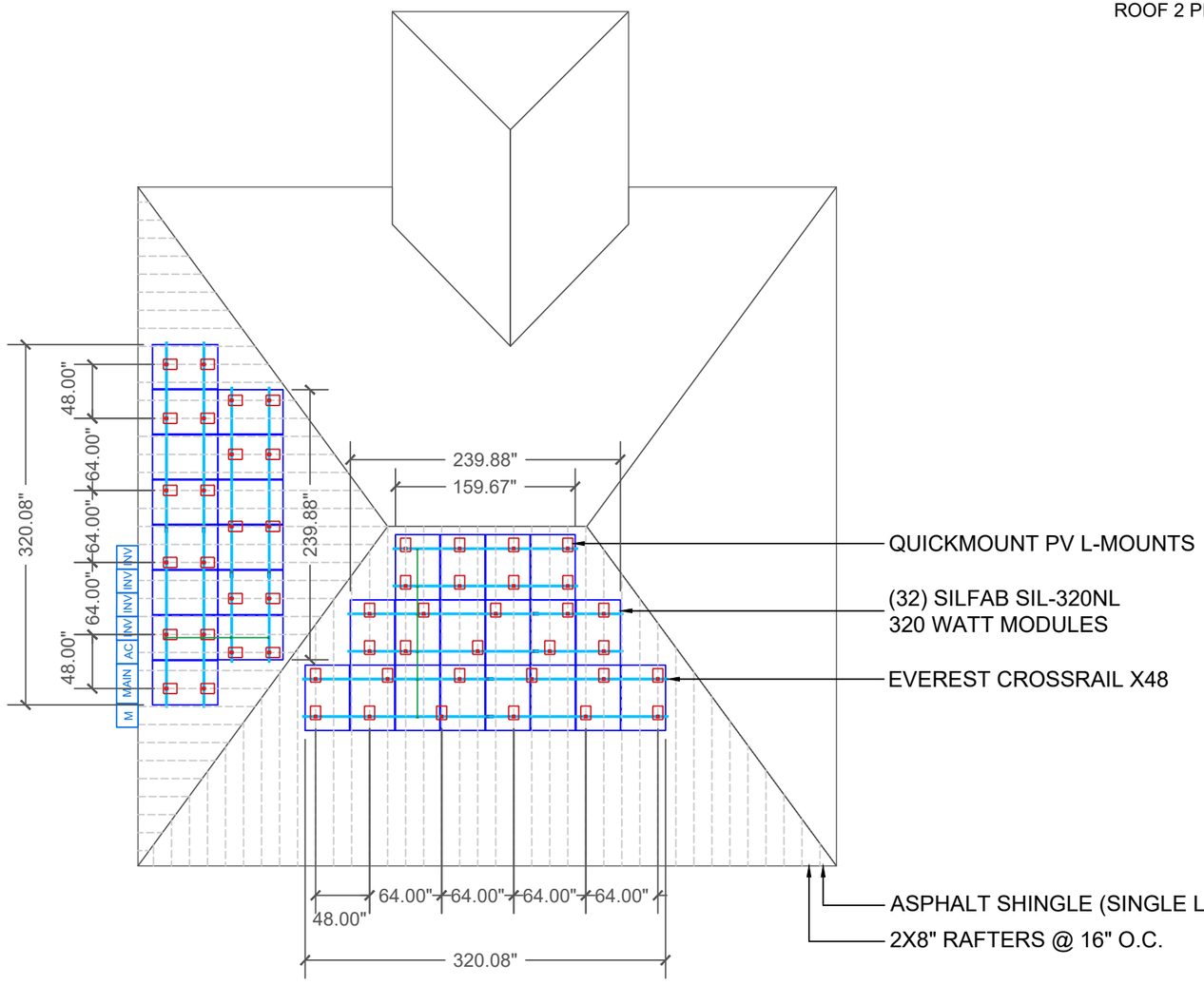
SHEET NUMBER

PV-1

ROOF PLAN

SCALE: 3/32"=1'-0"

ROOF 1 PITCH: 25°
ROOF 2 PITCH: 25°



Flashings/Mounts	
Manufacturer	Quickmount PV
Mount Type	L-Mount
Flashing Material	Aluminum
Flashing Size	9" x 12" x .04"
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

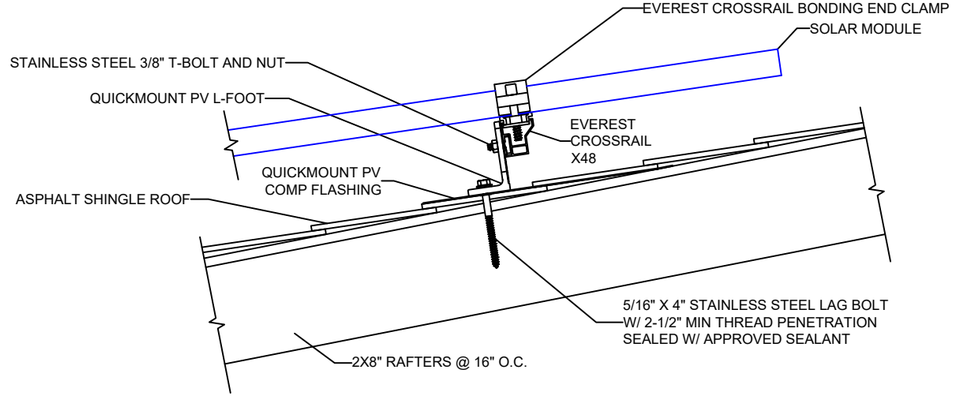
Racking	
Manufacturer	Everest Solar
Model Number	Crossrail 48-X
Length	166"
Width	1.54"
Height	1.89"
Weight	0.56 Lbs./Ft
Material	Aluminum
Structural	IBC Compliant
UL Listing	UL 2703

LEGEND

M UTILITY METER	DC DC DISCONNECT	PV METER	RAILS
MSP MAIN SERVICE PANEL	JB JUNCTION BOX	EXTERIOR CONDUIT	GROUNDING
INV INVERTER	SUB SUBPANEL	GAS METER	RAIL SPLICE
AC AC DISCONNECT	LC LOAD CENTER	FLASHINGS	

LOAD CALCULATIONS

NUMBER OF MODULES	32	
MODULE WEIGHT	41	LBS
MODULE SQ FT	18.3046	SQ FT
TOTAL MODULE WEIGHT	1312	LBS
TOTAL MODULE SQ FT	585.7472	SQ FT
NUMBER OF PORTRAIT	32	
NUMBER OF LANDSCAPE	0	
NUMBER OF OPTIMIZERS	32	
WEIGHT PER OPTIMIZER	1.5	LBS
TOTAL OPTIMIZER WEIGHT	48	LBS
TOTAL LENGTH OF RAIL	214	LF
RAIL WEIGHT PER FOOT	0.56	LBS
TOTAL RAIL WEIGHT	119.84	LBS
NUMBER OF FLANGES	52	
WEIGHT PER FLANGE	0.7565	LBS
WEIGHT PER SYSTEM	39.338	LBS
NUMBER OF MID CLAMPS	54	
MID CLAMP WEIGHT	0.21	LBS
WEIGHT PER SYSTEM	11.34	LBS
NUMBER OF END CLAMPS	20	
END CLAMP WEIGHT	0.32	LBS
WEIGHT PER SYSTEM	6.4	LBS
NUMBER OF SPLICES	8	
WEIGHT PER SPLICE	0.1	LBS
WEIGHT PER SYSTEM	0.8	LBS
TOTAL ARRAY WEIGHT	1537.718	LBS
POINT LOAD	29.5715	LBS/FT
TOTAL ARRAY AREA	585.7472	SQ FT
ARRAY DEAD LOAD	**2.6252**	**PSF**



SOLAR MOUNTING DETAIL

CONTRACTOR

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SHEET NAME

ROOF LAYOUT & DETAIL DRAWINGS

SHEET NUMBER

PV-2

Solar PV Module Data

Manufacturer	Silfab
Model Number	SIL-320NL
Max Power (Pmax)	320
Max Power Voltage (Vmp)	32.88
Max Power Current (Imp)	9.74
Open Circuit Voltage (Voc)	40.1
Short Circuit Current (Isc)	10.32
Max Series Fuse (OCPD)	20
Max System Voltage	1000
UL Listing	UL1703
Protection Rating	IP67

Power Optimizer Data

Manufacturer	SMA
Model Number	TS4-R-F
Rated DC Input Power	475
Max Input Voltage	90
Max Input Current	10.32
Max Short Circuit Current	12
Max Output Voltage	40.1
Max Output Current	9.74
UL Listing	UL1741
Protection Rating	IP68/NEMA4X

Inverter Data

Manufacturer	SMA
Model Number	SB6.0-1SP-US-41
Max DC Input Voltage	600
Nominal DC Input Voltage	480
Max DC Input Current	30
Max DC Short Circuit Current	54
Max DC Input Power	8520
Max AC Output Power	6000
Nominal AC Output Voltage	240
Max AC Output Current	25
Strings Per Inverter	1 - 3
UL Listing	UL1741
Enclosure Rating	NEMA 3R

Junction Box Data

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

Battery Inverter Data

Manufacturer	SMA
Model Number	SI6048-US-10
Rated Grid Voltage / AC Voltage Range	120V / 105-132V
Rated AC Output Power	5750 Watts
Rated Current / Max Output Current	48A / 180A for 60ms
Rated Input Voltage / AC Input Voltage Range	120V / 80V-150V
Max AC Input Current / Rated AC Input Current	56A / 0A-56A
Max AC Input Power	6700 Watts
Rated Battery Input Voltage / Voltage Range	48V / 41V-63V
Max Charge Current / DC Rated Charge Current	130A / 110A
Number of Inverters	2
UL Listing	UL1741
Enclosure Rating	NEMA 1

Battery Data

Manufacturer	Full River
Model Number	DC400-6
Battery Type	Sealed AGM
Nominal Voltage	6 Volts
Rated Capacity	400 Amp Hours
Cycling Capacity (20Hr Rate)	415 Amp Hours
Battery Dimensions	16.69" (H) x 11.61" (L) x 7.05" (W)
Weight	6700 Watts
UL Listing	48V / 41V-63V
Number of Batteries	130A / 110A

AC Disconnect Data "A"

Manufacturer	Eaton
Model Number	DH223NRV
Voltage Rating	240
Amperage Rating	100
Phase	Single
Switch Syle	Fusible
Fuse Rating	70
UL Listing	UL 98
Enclosure Rating	NEMA 3R

AC Disconnect Data "B"

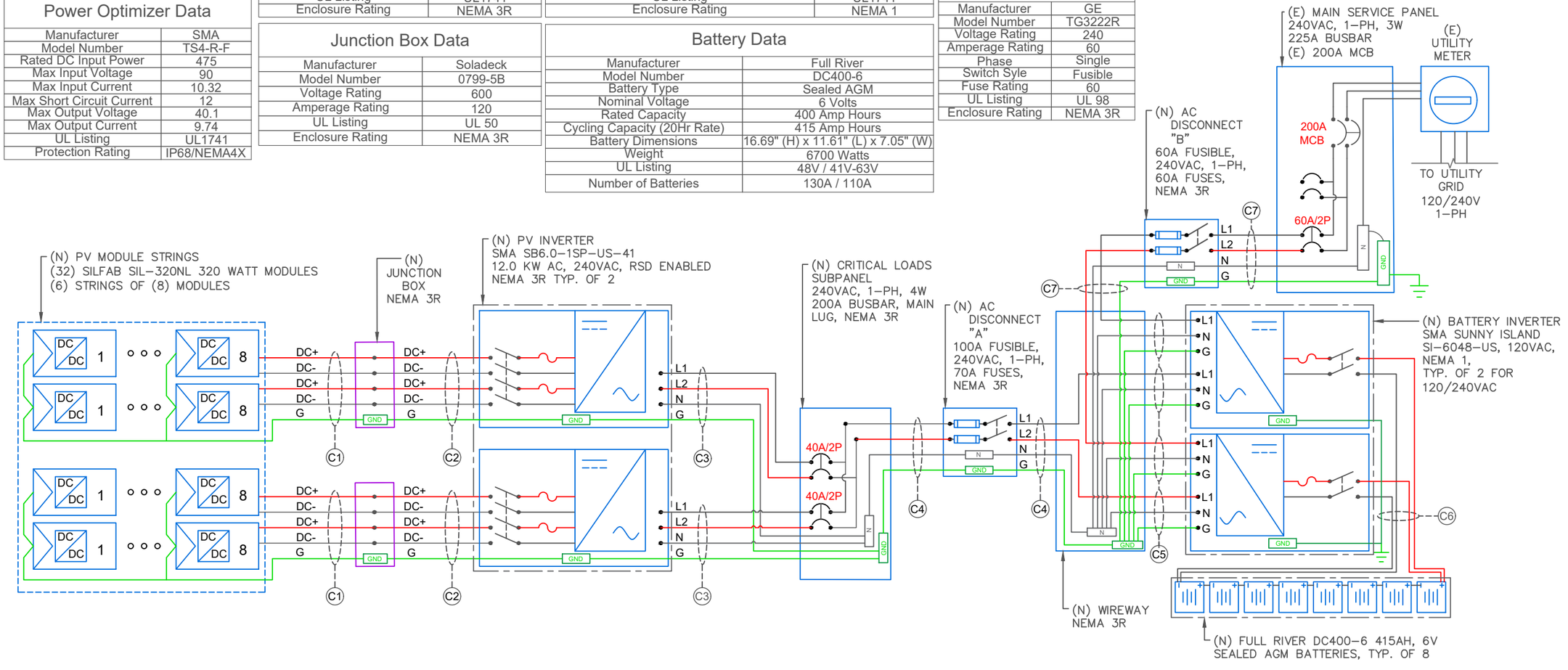
Manufacturer	GE
Model Number	TG3222R
Voltage Rating	240
Amperage Rating	60
Phase	Single
Switch Syle	Fusible
Fuse Rating	60
UL Listing	UL 98
Enclosure Rating	NEMA 3R

Main Service Panel Data

Manufacturer	Eaton
Model Type	Cutler Hammer
Model Number	CH32B225R
Voltage Rating	120/240
Busbar Amp Rating	225A
Main Breaker/Main Lug	Main Breaker
Breaker Amp Rating	200A
Phase	Single
UL Listing	UL 67
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	4	10 AWG	COPPER	PV WIRE	1	8 AWG	BARE COPPER	N/A	-	-	-	FREE AIR	PANELS TO JUNCTION BOX
C2	4	10 AWG	COPPER	THHN/THWN-2	1	10 AWG	COPPER	THHN/THWN-2	1	3/4"	LFMC/EMT	EXTERIOR/INTERIOR	JUNCTION BOX TO INVERTERS
C3	3	8 AWG	COPPER	THHN/THWN-2	1	10 AWG	COPPER	THHN/THWN-2	1	3/4"	LFNC/EMT	EXTERIOR	INVERTER TO SUBPANEL
C4	3	8 AWG	COPPER	THHN/THWN-2	1	10 AWG	COPPER	THHN/THWN-2	1	3/4"	LFNC/EMT	EXTERIOR	SUBPANEL TO DISCONNECT
C5	2	6 AWG	COPPER	THHN/THWN-2	1	6 AWG	COPPER	THHN/THWN-2	1	3/4"	LFNC	EXTERIOR	WIREWAY TO SUNNY ISLAND
C6	2	2/0 AWG	COPPER	MTW/AWM	1	6 AWG	COPPER	BARE	1	1-1/2"	PVC	INTERIOR	EGC TO GROUND ROD
C7	3	6 AWG	COPPER	THHN/THWN-2	1	10 AWG	COPPER	THHN/THWN-2	1	1"	LFNC	EXTERIOR	INTERCONNECTION TO MSP

CONTRACTOR

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ENGINEER OF RECORD

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REVISIONS

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SHEET SIZE

ANSI B
11" X 17"

DATE

8/19/2020

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: Silfab Solar SIL-320NL
Inverter: SMA Sunny Boy SB6.0-1SP-US-41

Initial Input Values

Isc (Short Circuit Current)	10.32					
Number of circuits	10.32	x	1	=	10.32	
Maximum Circuit Current (NEC 690.8 (A)(1+2)	10.32	x	156%	=	16.0992	
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	4-6	40	x	0.8	=	32
Temperature Derating (°F)	132-140	32	x	0.71	=	22.72

Ampacity vs Overcurrent Device

Conductor Ampacity Check	22.72	16.0992	OK	
Conductor to Overcurrent Check	22.72	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: Silfab Solar SIL-320NL
Inverter: SMA Sunny Boy SB6.0-1SP-US-41

Initial Input Values

Inverter Continuous AC Output Combined (Watts)	6000					
Minimum Operating Voltage	240					
	Watts		Volts		Amps	
	6000	/	240	=	25	
Inverter Continuous AC Amps	25					
Number of Inverters	25	x	1	=	25	

Overcurrent Device Rating					
NEC 690.8 (B)(3)	25	x	125%	=	31.25
Minimum Overcurrent Device	40	Amps			
Circuit Breaker Size per NEC 240.6(A)	40	Amps			
	Size AWG #				
Chosen Conductor Type THHN,THWN,RHW-2 or USE-2	8				

Conductor Derating

NEC 690.31© ref (NEC 310.16)						
Conductor 90°C Ampacity		55				
Conduit Fill Derating	1-3	55	x	1	=	55
Temperature Derating (°F)	96-104	55	x	0.91	=	50.05

Ampacity vs Overcurrent Device

Conductor Ampacity Check	50.05	31.25	OK	
Conductor to Overcurrent Check	50.05	40	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

OPERATING VOLTAGE: ____ VDC
OPERATING CURRENT: ____ AMPS
MAX SYSTEM VOLTAGE: ____ VDC
SHORT CIRCUIT CURRENT: ____ AMPS
CHARGE CONTROLLER MAX: ____ AMPS

NEC 690.53 — 1

APPLY TO:
INVERTER

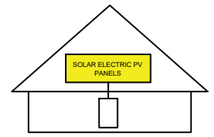
WARNING: PHOTOVOLTAIC POWER SOURCE

NEC 690.31(G)(3)(4) — 2

APPLY TO:
SOLAR DC CONDUIT

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:
SOLAREDGE INVERTERS

⚠ 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
SOLAR LOAD CENTERS
COMBINER BOXES

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

NEC 690.5(C)(3) — 5

APPLY TO:
SMA AND SOLAREDGE INVERTERS

PHOTOVOLTAIC SYSTEM
AC DISCONNECT

OPERATING VOLTAGE: ____ VDC
OPERATING CURRENT: ____ AMPS

NEC 690.54 — 6

APPLY TO:
AC DISCONNECT

⚠ WARNING

TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL

NEC 110.27(C) & OSHA 1910.145(f)(7) — 7

APPLY TO:
COMBINER BOXES
ENCLOSURES
BREAKER PANEL
MAIN SERVICE DISCONNECT

SOLAR PV BREAKER

BREAKER IS BACKFED
DO NOT RELOCATE

NEC 690.64(B)(7) & NEC 705.12(B)(2) — 8

APPLY TO:
PV SYSTEM BREAKER

⚠ WARNING

DUAL POWER SUPPLY

SOURCES: UTILITY GRID AND PV SOLAR ELECTRIC SYSTEM

NEC 705.12(D)(3) & NEC 690.64

APPLY TO:
MAIN SERVICE PANEL
METER

9

DC JUNCTION BOX

⚠ WARNING

ELECTRIC SHOCK HAZARD

THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED

PHOTOVOLTAIC POWER SOURCE

NEC 690.31(G)(2) — 10

APPLY TO:
DC JUNCTION BOXES

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LABELING SCHEDULE

SHEET NUMBER

PV-5

Silfab SOLAR

SIL-320 NL

BAA ARRA | 25 YEAR PRODUCT WARRANTY | AUTOMATED MANUFACTURING | JUST-IN-TIME | PVEL DNV·GL TOP PERFORMER | TIER 1 BANKABLE $$$ | HIGH EFFICIENCY

60 Cell
Monocrystalline PV Module

CE | Intertek | Intertek | IEC | Fraunhofer ISE | CEC LISTED

CHUBB*
* Chubb provides error and omission insurance to Silfab Solar Inc.

INDUSTRY LEADING WARRANTY
All our products include an industry leading 25-year product workmanship and 30-year performance warranty.

35+ YEARS OF SOLAR INNOVATION
Leveraging over 35+ years of worldwide experience in the solar industry, Silfab is dedicated to superior manufacturing processes and innovations such as Bifacial and Back Contact technologies, to ensure our partners have the latest in solar innovation.

NORTH AMERICAN QUALITY
Silfab is the leading automated solar module manufacturer in North America. Utilizing premium quality materials and strict quality control management to deliver the highest efficiency, premium quality PV modules 100% made in North America.

BAA / ARRA COMPLIANT
Silfab panels are designed and manufactured to meet Buy American Act Compliance. The US State Department, US Military and FAA have all utilized Silfab panels in their solar installations.

LIGHT AND DURABLE
Engineered to accommodate low load bearing structures up to 5400Pa. The light-weight frame is exclusively designed for wide-ranging racking compatibility and durability.

LOWEST DEFECT RATE
Total automation ensures strict quality controls during the entire manufacturing process at our ISO certified facilities. 48.18 ppm as per December 2018.

DOMESTIC PRODUCTION
Silfab Solar manufactures our PV modules in two automated locations within North America. Our 300+ North American team is ready to help our partners win the hearts and minds of customers, providing customer service and product delivery that is direct, efficient and local.

AESTHETICALLY PLEASING
All black sleek design, ideal for high-profile residential or commercial applications.

PID RESISTANT
PID Resistant due to advanced cell technology and material selection. In accordance to IEC 62804-1.

Electrical Specifications		SIL-320 NL mono PERC	
Test Conditions		STC	NOCT
Module Power (Pmax)	Wp	320	242
Maximum power voltage (Vpmax)	V	32.88	29.59
Maximum power current (Ipmax)	A	9.74	8.18
Open circuit voltage (Voc)	V	40.10	37.09
Short circuit current (Isc)	A	10.32	8.46
Module efficiency	%	18.8	17.8
Maximum system voltage (VDC)	V	1000	
Series fuse rating	A	20	
Power Tolerance	Wp	0 to +10	

Measurement conditions: STC 1000 W/m2 • AM 1.5 • Temperature 25 °C • NOCT 800 W/m² • AM 1.5 • Measurement uncertainty ≤ 3%
• Sun simulator calibration reference modules from Fraunhofer Institute. Electrical characteristics may vary by ±5% and power by 0 to +10W.

Temperature Ratings	SIL-320 NL mono PERC
Temperature Coefficient Isc	0.064 %/°C
Temperature Coefficient Voc	-0.28 %/°C
Temperature Coefficient Pmax	-0.36 %/°C
NOCT (± 2°C)	45 °C
Operating temperature	-40/+85 °C

Mechanical Properties and Components	SIL-320 NL mono PERC	
	Metric	Imperial
Module weight	18.6 kg ±0.2 kg	41 ±0.4 lbs
Dimensions (H x L x D)	1700 mm x 1000 mm x 38 mm	66.9 in x 39.4 in x 1.5 in
Maximum surface load (wind/snow)*	4000 Pa rear load / 5400 Pa front load N/m²	83.5/112.8 lb/ft^2
Hail impact resistance	ø 25 mm at 83 km/h	ø 1 in @ 51.6 mph
Cells	60 - Si mono PERC - 5 busbar 158.75 x 158.75 mm	60 - Si mono PERC - 5 busbar 6.25 x 6.25 Inch
Glass	3.2 mm high transmittance, tempered, DSM anti-reflective coating	0.126 high transmittance, tempered, DSM anti-reflective coating
Cables and connectors (refer to installation manual)	1200 mm, ø 5.7 mm, MC4 compatible	47.2 in, ø 0.22 in, MC4 compatible
Backsheet	High durability, superior hydrolysis resistance, multi-layer dielectric film	
Frame	Anodized Aluminum (Black)	
Bypass diodes	3 diodes-30SQ045T (45V max DC blocking voltage, 30A max forward rectified current)	
Junction Box	UL 3730 Certified, IP67 rated	

Warranties	SIL-320 NL mono PERC			
Module product workmanship warranty	25 years**			
Linear power performance guarantee	30 years			
	≥ 97% end 1st year	≥ 90% end 12th year	≥ 82% end 25th year	≥ 80% end 30th year

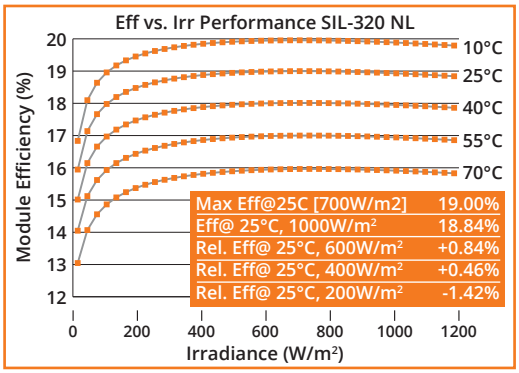
Certifications	SIL-320 NL mono PERC
Product	ULC ORD C1703, UL 1703, CEC listed, IEC 62716 Ammonia Corrosion; IEC61701:2011 Salt Mist Corrosion Certifed, UL Fire Rating: Type 2
Factory	ISO9001:2015

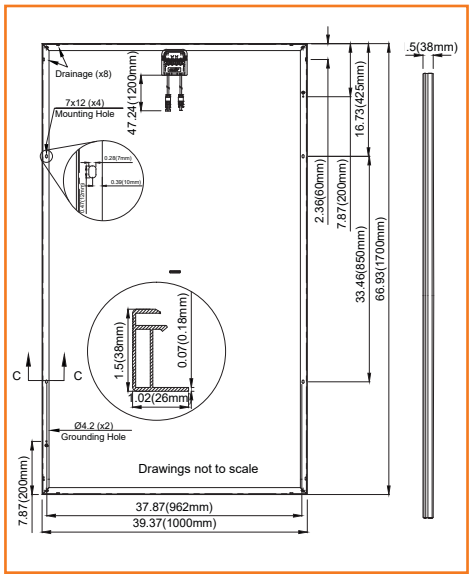
- Modules Per Pallet: 26
- Pallets Per Truck: 36
- Modules Per Truck: 936

*⚠ Warning. Read the Safety and Installation Manual for mounting specifications and before handling, installing and operating modules.

**12 year extendable to 25 years subject to registration and conditions outlined under "Warranty" at www.silfabsolar.com.

Third-party generated pan files from Fraunhofer-Institute for Solar Energy Systems ISE are available for download at: www.silfabsolar.com/downloads





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Bellingham WA 98225 USA
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2019 TOP PERFORMER PVEL DNV·GL PV MODULE RELIABILITY SCORECARD

TS4-R-F SUNSPEC RAPID SHUTDOWN

Cost-effective

- Simple to install via existing DC wires
- No additional components necessary, reducing balance of system costs

Simple and robust

- Power line based communication compatible with SunSpec signal for rapid shutdown
- Shuts down PV module whenever SunSpec signal is interrupted

Safe and reliable

- SunSpec compliant rapid shutdown that fulfills:
  - » UL 1741
  - » NEC 2014
  - » NEC 2017

Reduced risk

- Technical support from SMA's #1 ranked service organization
- Simple, safe repair or replacement of proprietary snap-in cover–no cabling work

TS4-R-F SUNSPEC RAPID SHUTDOWN

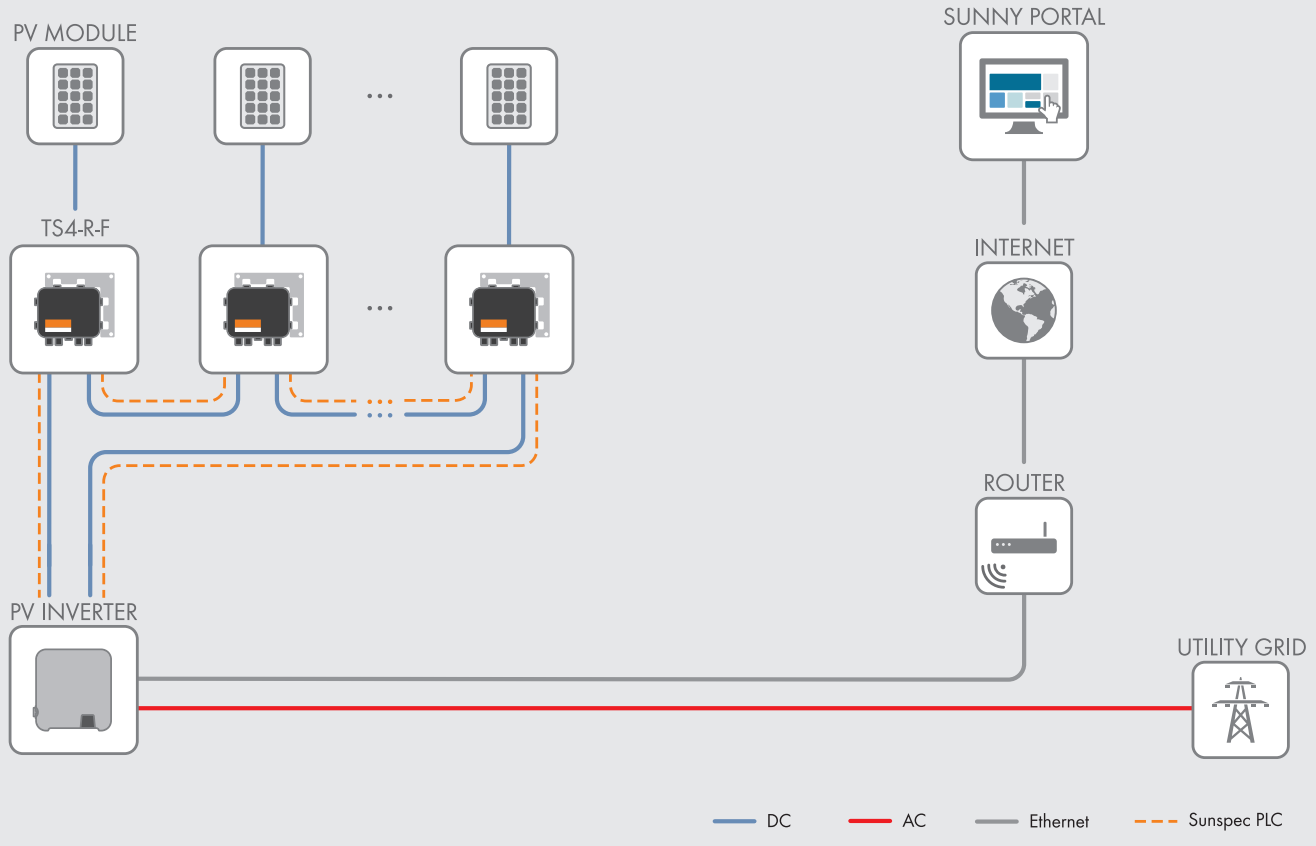
Compliance made simple and economical

The new TS4-R-F rapid shutdown solution is a cost-effective way to fulfill UL 1741, NEC 2014 and NEC 2017 requirements. It is compatible with the power line based SunSpec communication signal for rapid shutdown, making it simple to implement with robust functionality. Using the existing DC wires between the inverter and module-level electronics as a communication channel significantly reduces installation time and labor costs, since no additional communication equipment is needed. The TS4-R-F's compliance with the SunSpec open standard makes it the most flexible solution on the market, as it can be combined with multiple types of inverters.

Technical data	TS4-R-F 478-00252-42
Input	
Rated DC input power	475 W
Maximum PV module open circuit voltage @ STC	75 V
Maximum input voltage	90 V
Maximum current Isc	12 A
Output	
Output power range	0 - 475 W
Output voltage range	0 - Voc
Communication type	SunSpec Rapid Shutdown
Rapid shutdown compliant (NEC 2017 690.12)	Yes
Maximum system voltage	1000 V
Maximum series fuse rating	15 A
Mechanical	
Operating temperature range	−40°C to +85°C (−40°F to +185°F)
Non-operating temperature range	−40°C to +85°C (−40°F to +185°F)
Cooling method	Natural convection
Dimensions with cover	152.5 mm x 108 mm x 25.3 mm
Weight with cover	610 g
Environmental rating	IP68, NEMA 4X
Cabling	
Cabling type / Output cable length	H1Z2Z2-K / 1.2 m (solar cable, certified to EN 50618)
Cabling	MC4
UV resistance	500 hr with UVB light between 300 and 400 nm at 65° C

Type designation	TS4-R-F 478-00252-42

SYSTEM DIAGRAM



Toll Free +1 888 4 SMA USA
www.SMA-America.com

SMA America, LLC

SUNNY BOY
3.0-US / 3.8-US / 5.0-US / 6.0-US / 7.0-US / 7.7-US

SB3.0-1SP-US-41 / SB3.8-1SP-US-41 / SB5.0-1SP-US-41 / SB6.0-1SP-US-41
SB7.0-1SP-US-41 / SB7.7-1SP-US-41 / SB3.0-1TP-US-41 / SB3.8-1TP-US-41
SB5.0-1TP-US-41 / SB6.0-1TP-US-41 / SB7.0-1TP-US-41 / SB7.7-1TP-US-41

Value-Added Improvements

- SunSpec certified technology for cost-effective module-level shutdown
- Advanced AFCI compliant to UL 1699B for arc fault protection

Reduced Labor

- New Installation Assistant with direct access via smartphone minimizes time in the field
- Advanced communication interface with fewer components creates 50% faster setup and commissioning

Optimized Power Production

- ShadeFix, SMA's proprietary shade management solution, produces more power than alternatives
- Reduced component count provides maximum system reliability

Trouble-Free Service

- SMA Service Mobile App provides simplified, expedited field service
- Equipped with SMA Smart Connected, a proactive service solution that is integrated into Sunny Portal

SUNNY BOY 3.0-US / 3.8-US / 5.0-US / 6.0-US / 7.0-US / 7.7-US

Power with a purpose

The residential PV market is changing rapidly. Your bottom line matters more than ever—so we've designed a superior residential solution to help you decrease costs at every stage of your business operations. The Sunny Boy 3.0-US/3.8-US/5.0-US/6.0-US/7.0-US/7.7-US join the SMA lineup of field-proven solar technology backed by the world's #1 service team. This improved residential solution features ShadeFix, SMA's proprietary technology that optimizes system performance. ShadeFix also provides superior power production with a reduced component count versus competitors, which provides maximum reliability. No other optimized solution generates more power or is as easy as systems featuring SMA ShadeFix and SunSpec certified devices. Finally, SMA Smart Connected will automatically detect errors and initiate the repair and replacement process so that installers can reduce service calls and save time and money.

Technical data	Sunny Boy 6.0-US		Sunny Boy 7.0-US		Sunny Boy 7.7-US	
	208 V	240 V	208 V	240 V	208 V	240 V
Input (DC)						
Max. PV power	9600 Wp		11200 Wp		12320 Wp	
Max. DC Voltage	600 V					
Rated MPP Voltage range	220 – 480 V		245 - 480 V		270 - 480 V	
MPPT operating voltage range	100 – 550 V					
Min. DC voltage / start voltage	100 V / 125 V					
Max. operating input current per MPPT	10 A					
Max. short circuit current per MPPT	18 A					
Number of MPPT tracker / string per MPPT tracker	3 / 1					
Output (AC)						
AC nominal power	5200 W	6000 W	6660 W	7000 W	6660 W	7680 W
Max. AC apparent power	5200 VA	6000 VA	6660 VA	7000 VA	6660 VA	7680 VA
Nominal voltage / adjustable	208 V / ●	240 V / ●	208 V / ●	240 V / ●	208 V / ●	240 V / ●
AC voltage range	183 – 229 V	211 – 264 V	183 – 229 V	211 – 264 V	183 – 229 V	211 – 264 V
AC grid frequency	60 Hz / 50 Hz					
Max. output current	25.0 A	25.0 A	32.0 A	29.2 A	32.0 A	32.0 A
Power factor (cos φ) / harmonics	1 / < 4 %					
Output phases / line connections	1 / 2					
Efficiency						
Max. efficiency	97.3 %	97.7 %	97.3 %	97.9 %	97.3 %	97.5 %
CEC efficiency	96.5 %	97.0 %	96.5 %	97.0 %	96.5 %	97.0 %
Protection devices						
DC disconnect device / DC reverse polarity protection	● / ●					
Ground fault monitoring / Grid monitoring	●					
AC short circuit protection	●					
All-pole sensitive residual current monitoring unit (RCMU)	●					
Arc fault circuit interrupter (AFCI)	●					
Protection class / overvoltage category	I / IV					
General data						
Dimensions (W / H / D) in mm (in)	535 x 730 x 198 (21.1 x 28.5 x 7.8)					
Packaging Dimensions (W / H / D) in mm (in)	600 x 800 x 300 (23.6 x 31.5 x 11.8)					
Weight / packaging weight	26 kg (57 lb) / 30 kg (66 lb)					
Temperature range: operating / non-operating	-25°C ...+60°C / -40°C ...+60°C					
Environmental protection rating	NEMA 3R					
Noise emission (typical)	39 dB(A)		45 dB(A)			
Internal power consumption at night	< 5 W					
Topology / cooling concept	transformerless / convection		transformerless / fan			
Features						
Ethernet ports	2					
Secure Power Supply	●*					
Display (2 x 16 characters)	●					
2.4 GHz WLAN / External WLAN antenna	●/o					
ShadeFix technology for string level optimization	●					
Cellular (4G / 3G) / Revenue Grade Meter	o/o**					
Warranty: 10 / 15 / 20 years ***	●/o/o					
Certificates and approvals	UL 1741, UL 1741 SA incl. CA Rule 21 RSD, UL 1998, UL 1699B Ed. 1, IEEE1547, FCC Part 15 (Class A & B), CAN/CSA V22.2 107.1-1, HECO Rule 14H, PV Rapid Shutdown System Equipment					
● Standard features o Optional features – Not available						
NOTE: US inverters ship with gray lids. Data at nominal conditions * Not compatible with SunSpec shutdown devices **Standard in SBX.X-1TP-US-41						
Type designation	SB6.0-1SP-US-41 / SB6.0-1TP-US-41		SB7.0-1SP-US-41 / SB7.0-1TP-US-41		SB7.7-1SP-US-41 / SB7.7-1TP-US-41	

POWER+ SOLUTION

The SMA Power+ Solution combines legendary SMA inverter performance and SunSpec certified shutdown devices in one cost-effective, comprehensive package. In addition, SMA ShadeFix technology optimizes power production and provides greater reliability than alternatives.

This rapid shutdown solution fulfills UL 1741, NEC 2014, and NEC 2017 requirements and is certified to the power line-based SunSpec Rapid Shutdown communication signal over DC wires, making it the most simple and cost-effective rapid shutdown solution on the market.

Visit www.SMA-America.com for more information.

Efficient

- CEC efficiency of 94.5% and 94%
- State of charge calculation
- Intelligent battery management for maximum battery life
- Now supports external BMS and lithium-ion technology

Simple

- Easy commissioning with the "Quick Configuration Guide"
- Complete off-grid management
- Excellent for grid-tied battery back up

Flexible

- For Sunny Island systems from 4.5 to 100 kW
- Single, split-phase and three-phase operation, connectable in parallel and modularly expandable
- AC and DC coupling

Durable

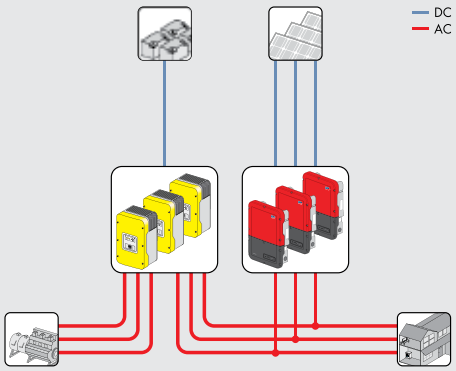
- Extreme overload capability
- OptiCool™ active temperature management system
- 5-year standard warranty

SUNNY ISLAND 4548-US / 6048-US

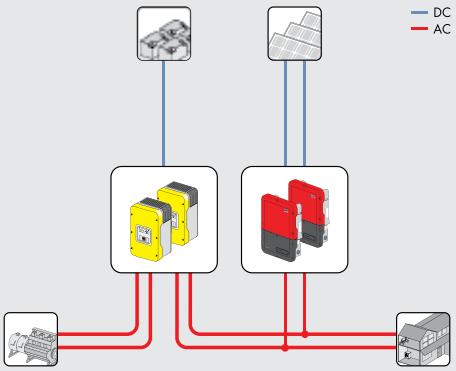
The efficient off-grid manager

The SMA Sunny Island 4548-US and 6048-US inverters are based on proven off-grid technology and feature industry leading power output. A maximum efficiency of 96 percent ensures peak production, which results in reduced diesel usage in rural communities. More flexible sizing allows for simplified system planning. And, with multicluster technology, up to 12 Sunny Islands can be integrated into off-grid power systems up 110 kW in size.

Technical data	Sunny Island 4548-US	Sunny Island 6048-US
AC output (loads)		
Rated grid voltage / AC voltage range	120 V/105 V – 132 V	120 V/105 V – 132 V
Rated frequency / frequency range (adjustable)	60 Hz/55 Hz ... 65 Hz	60 Hz/55 Hz ... 65 Hz
AC power (at 25 °C / at 40 °C) for 3 hours	5000 W/4000 W	6000 W/5000 W
Rated power (@ U_{nom}, f_{nom} / 25 °C / @ cos φ = 1)	4500 W	5750 W
AC power at 25 °C for 30 min / 1 min / 3 s	5300 W / 8400 W / 11000 W	7000 W / 8400 W / 11000 W
Rated current / max. output current (peak)	37.5 A/180 A for approx. 60 ms	48 A/180 A for approx. 60 ms
Total harmonic factor output voltage / power factor with rated power	3 % / -1 ... +1	3 % / -1 ... +1
AC input (PV array or grid)		
Rated input voltage / AC input voltage range	120 V/80 V – 150 V	120 V/80 V – 150 V
Rated input frequency / allowable input frequency range	60 Hz/54 Hz ... 66 Hz	60 Hz/54 Hz ... 66 Hz
Max. AC input current / adjustable	56 A/0 A ... 56 A	56 A/0 A ... 56 A
Max. AC input power	6.7 kW	6.7 kW
Battery DC input		
Rated input voltage / DC voltage range	48 V/41 V – 63 V	48 V/41 V – 63 V
Max. battery charging current / DC rated charging current	100 A / 85 A	130 A / 110 A
Battery type / battery capacity range	Lead, NiCd, Li-ion /100 Ah ... 10000 Ah	Lead, NiCd, Li-ion /100 Ah ... 10000 Ah
External BMS compatible	●	●
Charge control	IUoU charge procedure with automatic full charge and equalization charge	IUoU charge procedure with automatic full charge and equalization charge
Efficiency / self-consumption		
Max. efficiency / CEC efficiency	96 % / 94.5 %	96 % / 94 %
Self-consumption without load / standby	25 W/4 W	25 W/4 W
Protective devices		
DC reverse polarity protection / DC fuse	● / ●	● / ●
AC short-circuit / AC overload	● / ●	● / ●
Overtemperature / battery deep discharge	● / ●	● / ●
General data		
Dimensions (W / H / D)	467 / 612 / 235 mm (18.4 / 24.1 / 9.3 inch)	467 / 612 / 235 mm (18.4 / 24.1 / 9.3 inch)
Weight	63 kg / 139 lb	63 kg / 139 lb
Operating temperature range	-25 °C ... +60 °C / -13 °F ... +122 °F	-25 °C ... +60 °C / -13 °F ... +122 °F
Features / function		
Operation and display / multi-function relay	Internal / 2	Internal / 2
Degree of protection (according to IEC 60529)	indoors (NEMA 1)	indoors (NEMA 1)
Three-phase systems / parallel connection	● / ●	● / ●
Integrated bypass / multicluster operation	– / ●	– / ●
State of charge calculation / full charge / equalization charge	● / ● / ●	● / ● / ●
Integrated soft start / generator support	● / ●	● / ●
Battery temperature sensor / data cable	● / ●	● / ●
Warranty	5 years	5 years
Certificates and approvals	www.SMA-Solar.com	www.SMA-Solar.com
Accessories		
Battery cable / battery fuse	O / O	O / O
Interface (RS 485 / Multicluster PB)	O / O	O / O
Extended generator start "GenMan"	O	O
Load-shedding protection / battery current measurement	O / O	O / O
● Standard feature O Optional feature – Not available		
Type designation	SI4548-US-10	SI6048-US-10



Three-phase system



Split-phase system

DC400-6

DEEP CYCLE

400AH @ 20Hr
6-Volt

Group Size: L16 / 903

Maintenance-Free
Sealed AGM Battery

CYCLING CAPACITY

20 Hour Rate	**415 Amp Hours**

RESERVE CAPACITY

Reserve @25 AMPS	**885 Minutes**	Reserve @75 AMPS	**229 Minutes**

ELECTRICAL SPECIFICATIONS

Nominal Voltage	**6 Volt**
C100	**460AH**
C20	**415AH**
C10	**374AH**
C5	**340AH**
CCA	**1500**
CA or MCA	**1800**
HPCA	**2000 Amps**
Internal Resistance	**1.6m Ω**

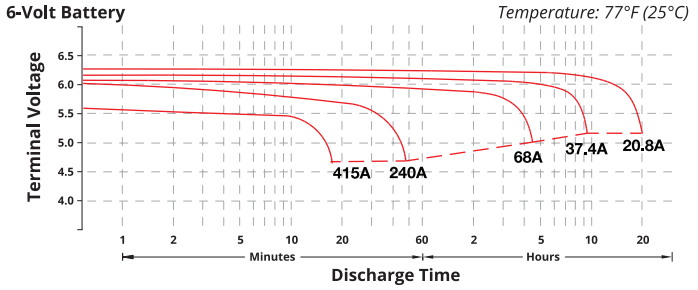
MECHANICAL SPECIFICATIONS

Group Size	**L16 / 903**	
Terminal Type	**DTW**	
Terminal Torque	**See reverse side**	
Height (w/ terminal)	**16.69"**	**424mm**
Height (case only)	**15.90"**	**404mm**
Width	**7.05"**	**179mm**
Length	**11.61"**	**295mm**
Weight	**123.2 lbs.**	**56 kg**
Case Type	**ABS Plastic -** Flame Res. Rating UL94-HB	

DISCHARGE TABLE (Constant Current)

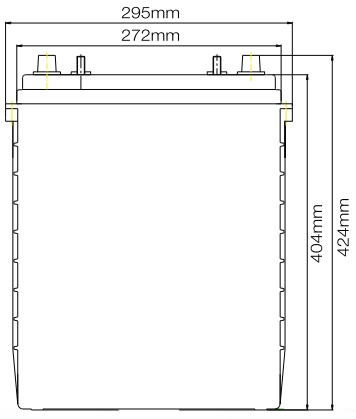
Time	Amps	Rate
20hr	20.8	0.05CA
10hr	37.4	0.10CA
8hr	45.1	0.13CA
5hr	68.0	0.25CA
3hr	93.9	0.33CA
2hr	123	0.50CA
1hr	232	1.00CA

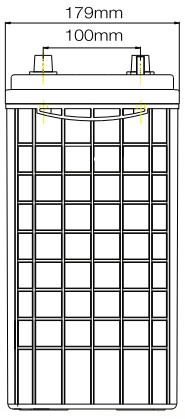
DISCHARGE PROFILE (Constant Current)

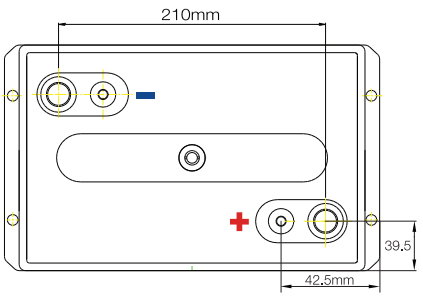


- All listed ratings are @ 100% SoC, T=77°F (25°C), 1.75VPC unless otherwise specified.
- Specifications listed are for estimation purposes only. Battery performance can vary depending on application. Battery design subject to change.

BATTERY & TERMINAL DIMENSIONS (All units shown in mm)

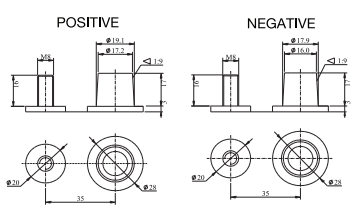






Battery bank spacing required, 12.5mm (1/2" inch) minimum

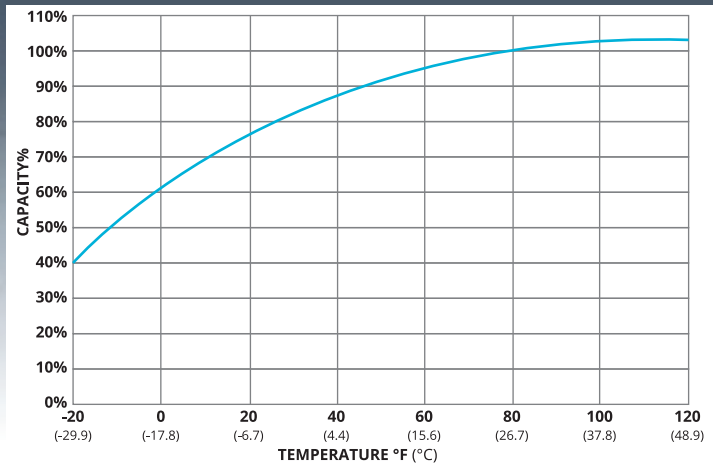
Terminal: DTW (Dual AP & Stud)



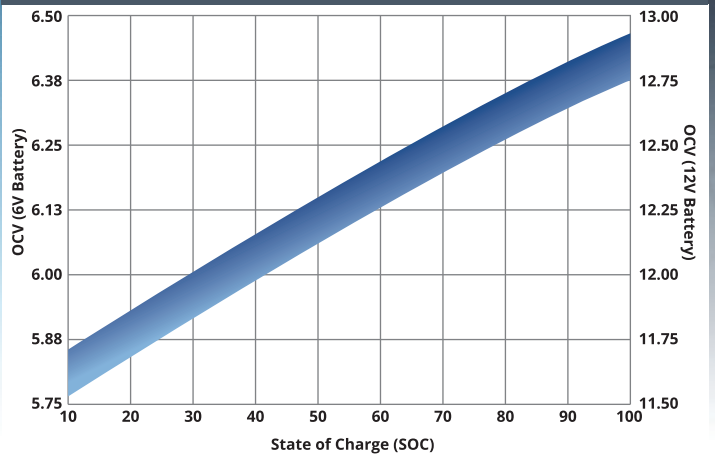
(unit: mm)

DC1150-2 DATA SHEET fullriverbattery.com

TEMPERATURE vs CAPACITY

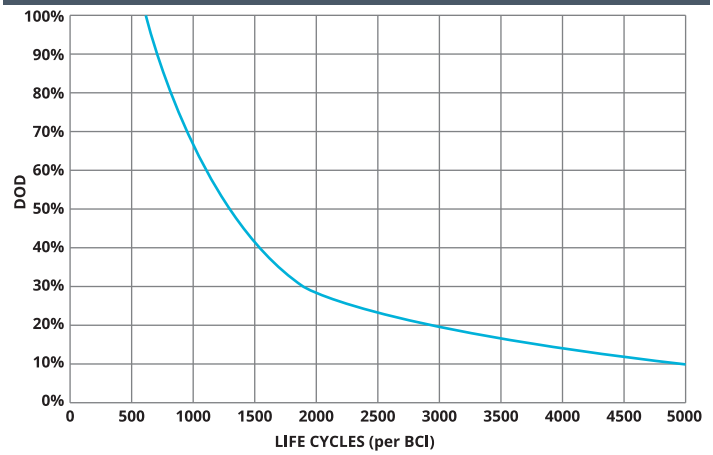


STATE of CHARGE (SOC) vs OPEN CIRCUIT VOLTAGE (OCV)

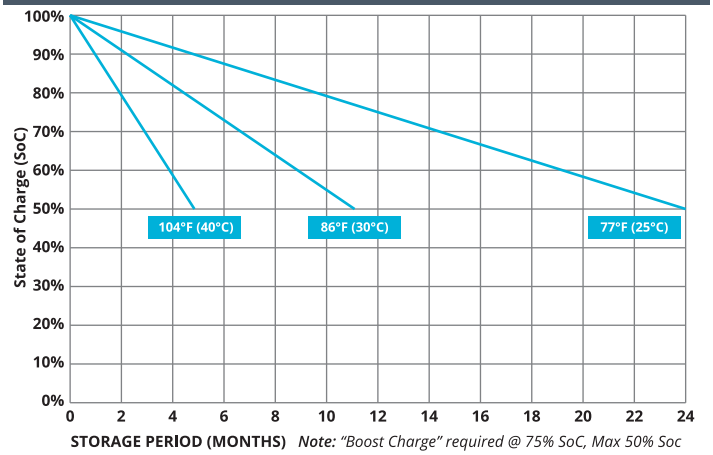


CYCLE LIFE vs DEPTH of DISCHARGE (DOD)

*(Based on BCI Testing @ 2-hr Rate)



SELF DISCHARGE vs TIME/TEMPERATURE



Note: "Boost Charge" required @ 75% SoC, Max 50% Soc

TEMPERATURE RANGE SPECIFICATIONS

Condition	Recommended	Maximum	Recommended	Maximum
Storage	5°F to 122°F	-40°F to 160°F	-15°C to 50°C	-40°C to 71°C
Operation	5°F to 104°F	-40°F to 160°F	-15°C to 40°C	-40°C to 71°C
Charge with TC	5°F to 122°F	-40°F to 160°F	-15°C to 50°C	-40°C to 71°C
Charge w/o TC	32°F to 104°F	5°F to 122°F	0°C to 40°C	-15°C to 50°C

TC*= *Temperature Compensation

CHARGE VOLTAGES

	Battery Voltages			
Charge Stage	**12V**	**24V**	**36V**	**48V**
Bulk	14.7V	29.4V	44.1V	58.8V
Absorption	14.7V	29.4V	44.1V	58.8V
Float	13.6V	27.2V	40.8V	54.6V

TC Factor: (-2mV°F/cell) or (-4mV°C/cell)

TERMINAL TORQUE SPECS

Terminal Type	ft-lbs	in-lbs	Nm
AP, DT *(AP)*, **M6, M6M** *(Stud)*, **TP07** *(AP)* ,**TP08** *(AP)*	**4.2 - 6.0**	**50-70**	**5.6 - 7.9**
FR45	**6.0 - 7.5**	**70-90**	**7.9 - 10.1**
M8	**7.1 - 8.0**	**85-95**	**9.6 - 10.7**
DT *(Stud)*, **M10M** *(Stud)*	**9.2 - 10.4**	**110-125**	**12.2 - 14**

ISO CERTIFIED

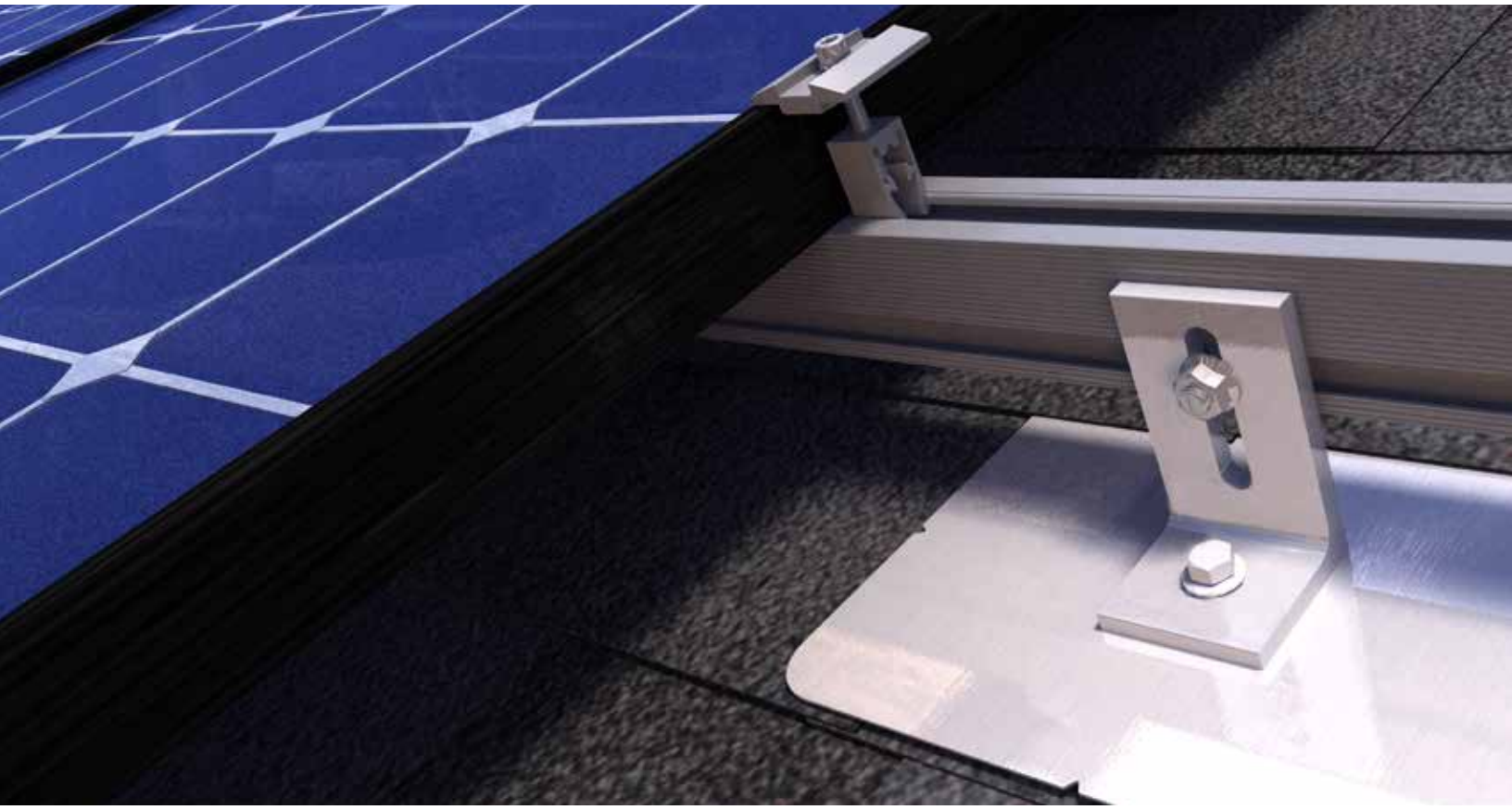
9001:2008 Quality Management System
14001:2004 Environmental Management System
18001:2007 Occupational Health & Safety Management System

DEEP 100% CYCLE

DELIVERY APPROVED! LAND, SEA & AIR

Fullriver batteries are sealed lead acid batteries made with Absorbed Glass Mat (AGM) technology. The electrolyte is absorbed into the fiberglass separator material rather than in a free-flowing liquid form. Fullriver batteries are non-spillable electric storage batteries. They are excepted from the requirements of DOT's hazardous materials regulations, since they adhere to the requirements of code 49 CFR Section 173.159(D) - **(CLASSIFIED APPROVED: DOT, CFR, HMR49, IATA, ICAO67, IMDG27)**

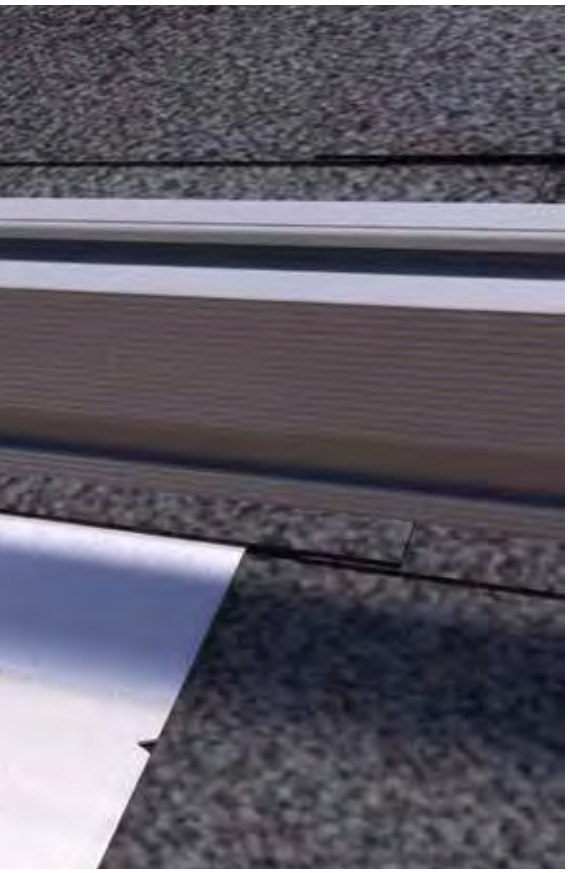
L-Mount® Series

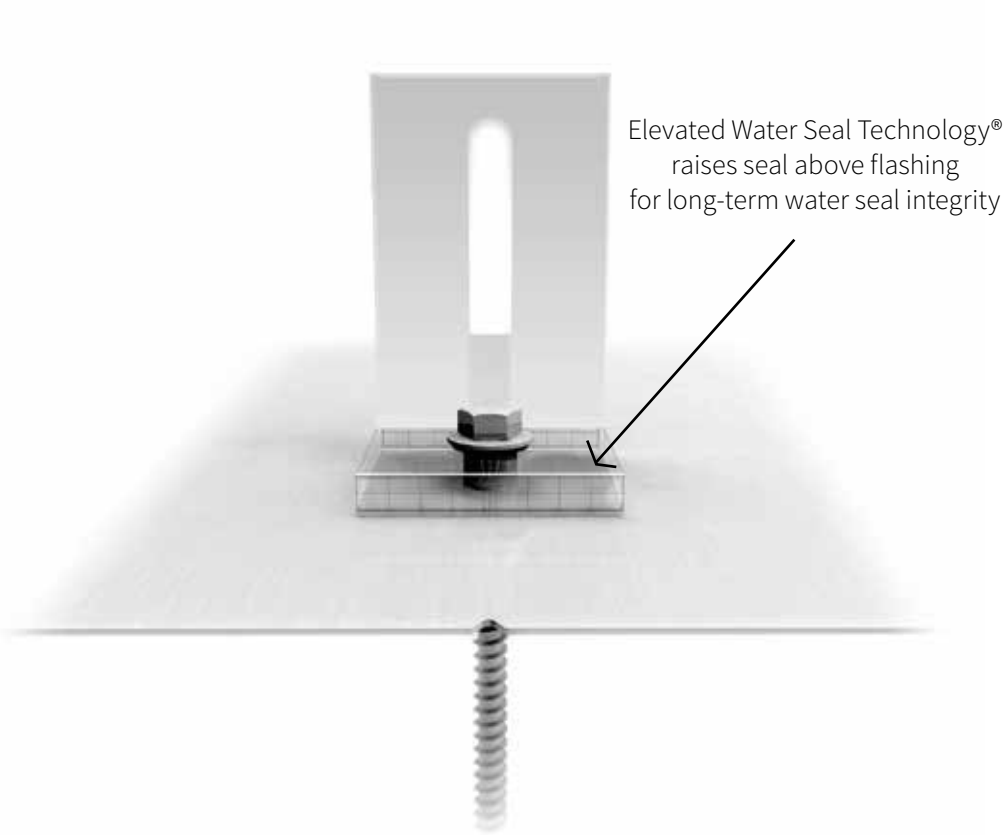


The L-Mount ® Series is designed for cost-effective, one-bolt installation onto existing composition/asphalt shingle roofs. Quick Mount PV engineered its patented Elevated Water Seal Technology® into an integrated L-foot and flashing for super-fast, single-lag bolt installation with unparalleled waterproofing. The L-Mount comes with a lag bolt or structural screw for attachment versatility and works with all leading racks. The L-Mount features a 9" x 12" aluminum flashing with alignment guides and rounded corners to easily slide under shingles and speed installation on the roof.

Features

- L-foot can be rotated 360 degree for optimal adjustability
- Works with all leading racks
- Available with lag bolt or structural screw
- QBlock® Elevated Water Seal Technology®
- Single bolt installation, no shingle cutting
- 9" x 12" aluminum flashing
- Meets or exceeds roofing industry best practices; 100% IBC compliant
- 18-8 stainless steel hardware included
- Alignment guides
- 25-year warranty



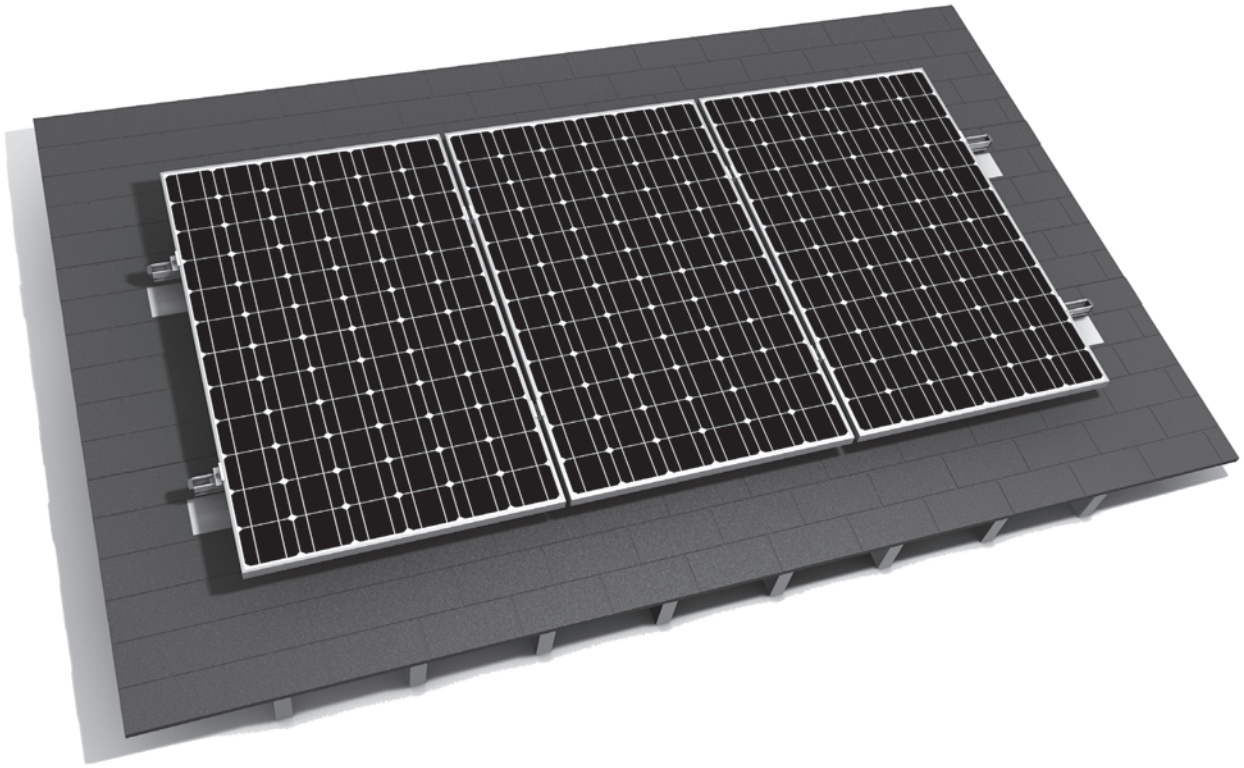


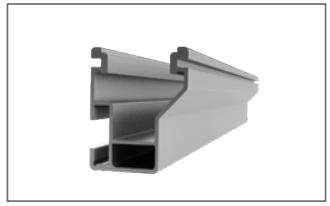
Single-Slot L-Mount with lag bolt

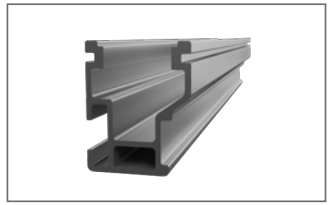
Single-Slot L-Mount

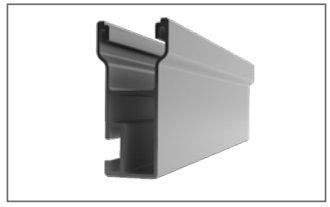
Available finishes:
aluminum mill (A); black (B)

Mounting systems for solar technology









EVEREST SOLAR SYSTEMS

RESIDENTIAL ROOF SOLUTIONS
CROSSRAIL SYSTEM

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Service-Hotline +1.760.301.5300
info@everest-solarsystems.com
www.everest-solarsystems.com

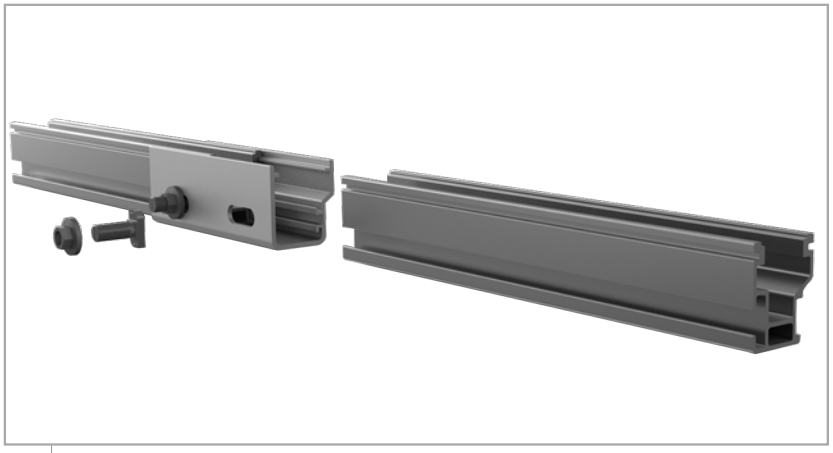
CROSSRAIL SYSTEM

LISTED

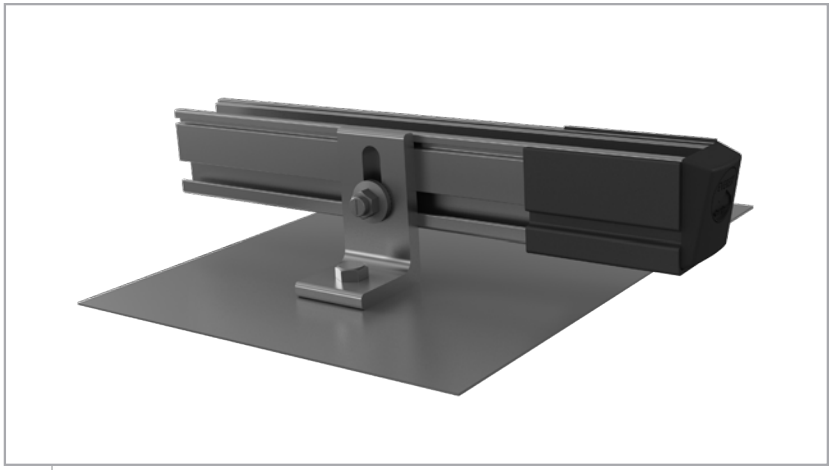
- High quality, German-engineered system optimized for residential installation
- MK3 mounting hardware simplifies module installation – fast, easy, and secure
- Easily integrates with third party roof attachment products
- L-foot provides adjustability and compatibility with common roof types
- 100% code-compliant, structural validation for all solar states
- Three rail sizes available to suit all structural conditions
- Most components also available in dark
- Fast installation with minimal component count result in low total installed cost
- Simple to design using code compliant Everest Online Design Tool
- Use two innovative components to turn this system into Shared Rail or Tilt Up

TECHNICAL DATA

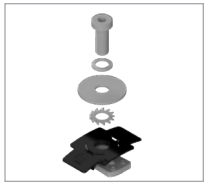
Applicable roof types	Composition shingle, tile, flat tile
Flexibility	Modular construction, suitable for any system size, height adjustable
PV modules	For all common module types
Module orientation	Portrait and landscape
Material	High corrosion resistance, stainless steel and high grade aluminum
Roof attachment	Screw connection into rafter
Structural validity	IBC compliant, stamped engineering letters available for all solar states
Warranty	20 years
System components	CrossRail 48-X/48-XL/80, L-Foot, Mid and End Clamp Sets



CrossRail Structural Splice



CrossRail with EverFlash, Rail Sleeve and End Cap



Bonding Mid Clamp | End Clamp | Micro, Optimizer & Accs Mounting Kit